DURAL VENOUS SINUSES CAVERNOUS SINUS

Dural Venous Sinuses 00:00:27

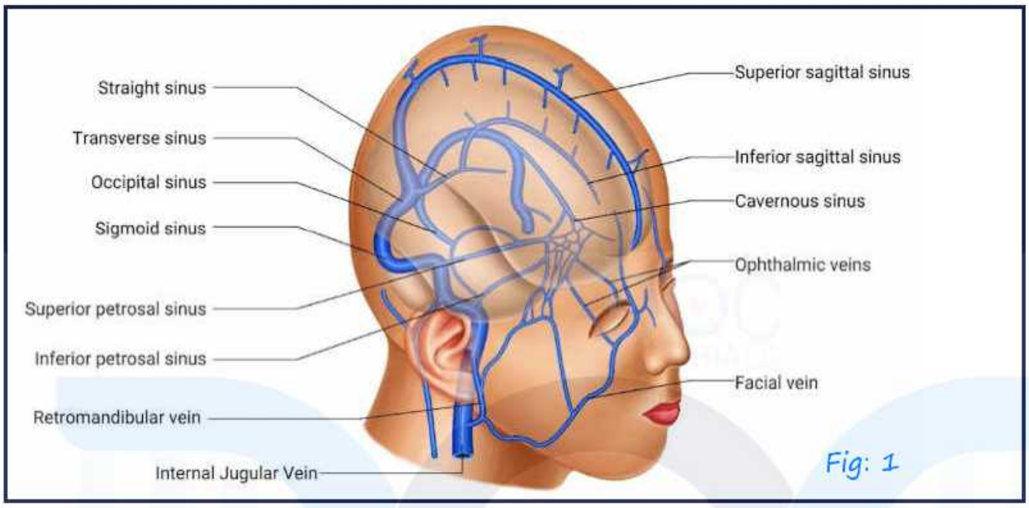

Straight sinus
Transverse sinus
Occipital sinus
Sigmoid sinus
Superior petrosal sinus
Inferior petrosal sinus
Retromandibular vein
Internal Jugular Vein
Superior sagittal sinus
Inferior sagittal sinus
Cavernous sinus
Ophthalmic veins
Facial vein

Fig: 1

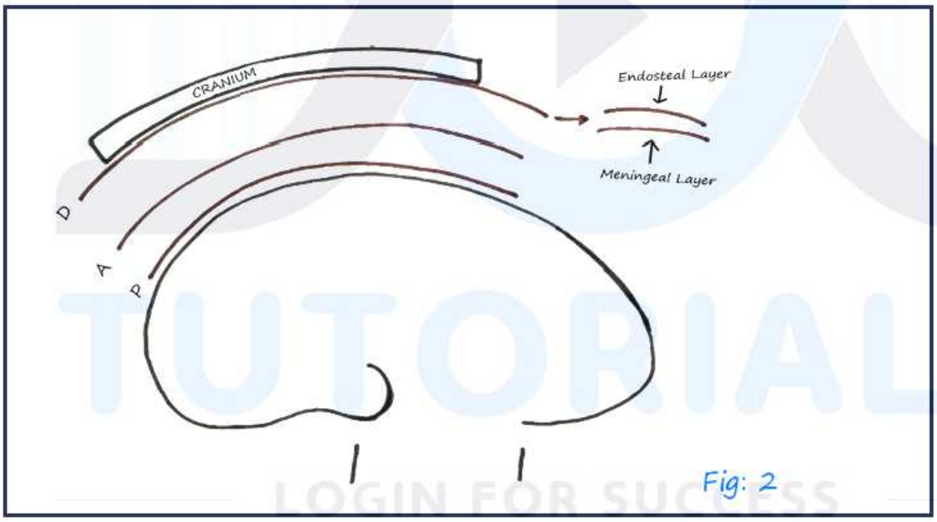
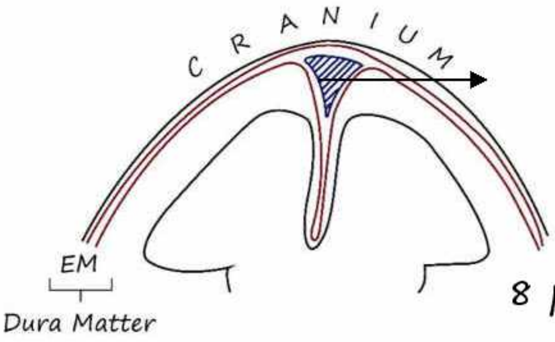

CRANIUM
Endosteal Layer
Meningeal Layer
D
A
P

Fig: 2

- Dura matter – 2 layers
  - Endosteal Layer (outside)
  - Meningeal Layer (inside)

Coronal section of cerebral hemisphere


CRANIUM
EM
Dura Matter

Dural venous Sinus → 23 dural venous sinuses

8 paired (16) + 7 unpaired = 23

Fig: 3

Dural venous sinuses = 23

8 paired = 16 + 7 Unpaired = 23

- Superior sagittal sinus (above falx cerebri)
- Inferior Sagittal Sinus (below falx cerebri)
  - Communicate via the Straight sinus.

FALX CEREBRI

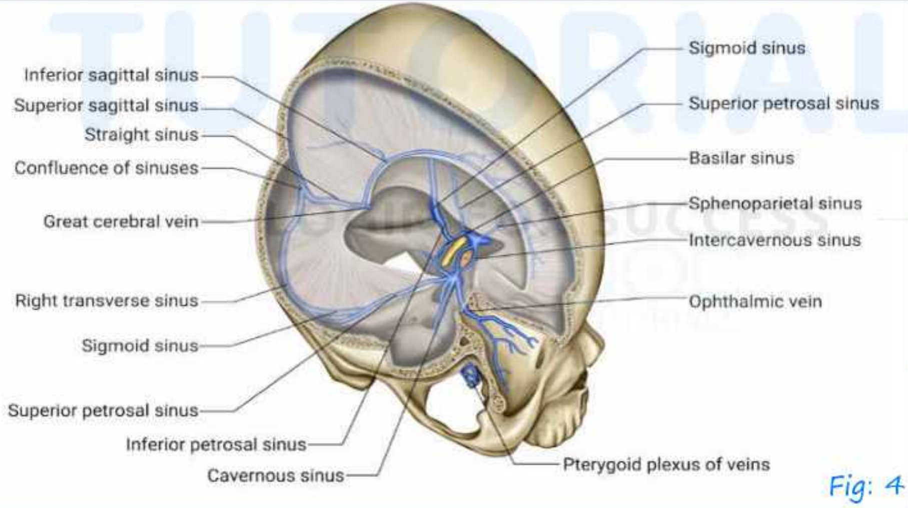

Inferior sagittal sinus
Superior sagittal sinus
Straight sinus
Confluence of sinuses
Great cerebral vein
Right transverse sinus
Sigmoid sinus
Superior petrosal sinus
Inferior petrosal sinus
Cavernous sinus
Sigmoid sinus
Superior petrosal sinus
Basilar sinus
Sphenoparietal sinus
Intercavernous sinus
Ophthalmic vein
Pterygoid plexus of veins

Fig: 4

- Inferior petrosal sinus + Sigmoid sinus

↓

INTERNAL JUGULAR VEIN

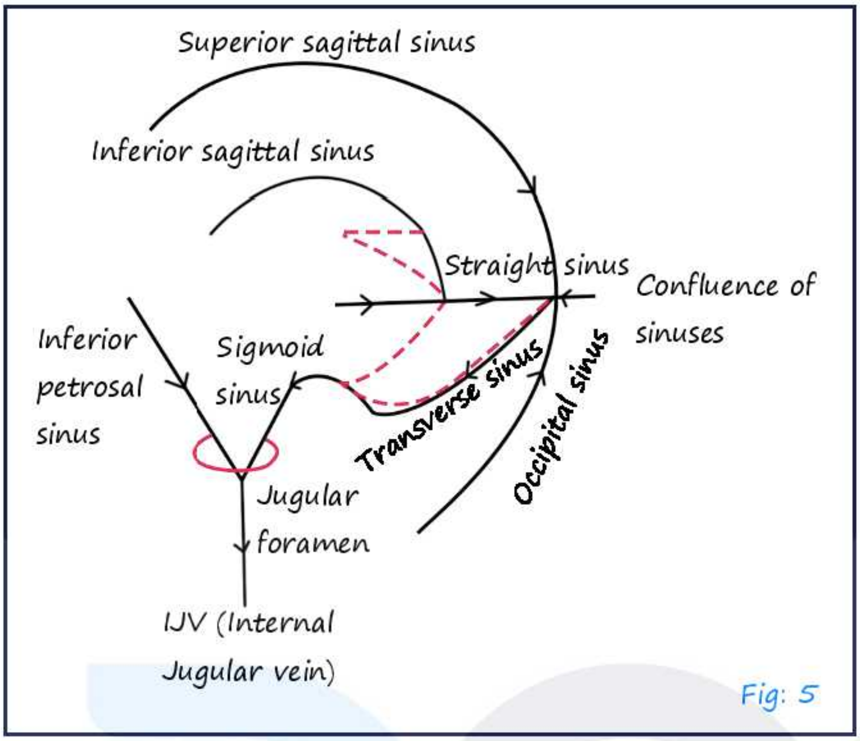

Superior sagittal sinus
Inferior sagittal sinus
Straight sinus
Confluence of sinuses
Inferior petrosal sinus
Sigmoid sinus
Transverse sinus
Occipital sinus
Jugular foramen
IJV (Internal Jugular vein)

Fig: 5

- Inferior petrosal sinus and the sigmoid sinus exit via the jugular foramen, and after coming out of it, form the internal jugular vein.
- Structures passing through jugular foramen:
  - Cranial nerves IX, X and XI
  - Inferior petrosal sinus
  - Sigmoid sinus
- Great Cerebral vein/Vein of Galen

↓ continues as

Straight line

Cavernous Sinus 00:14:57

- Paired sinus
- Location: either side of body of sphenoid bone.

Coronal Section 00:16:06

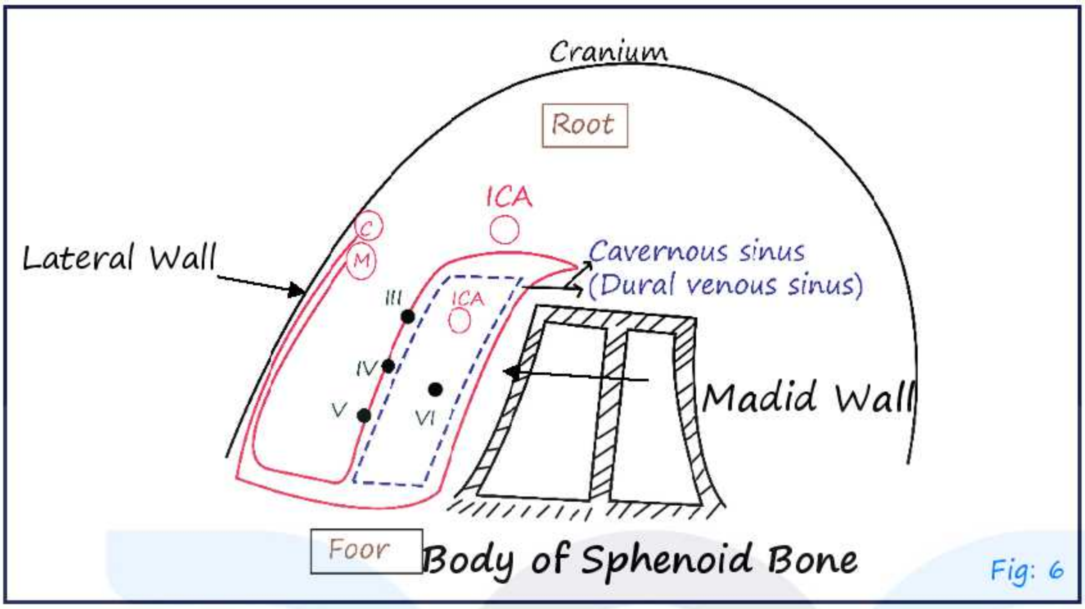

Cranium
Root
ICA
C
M
Lateral Wall
Cavernous sinus
(Dural venous sinus)
III
ICA
IV
V
VI
Madid Wall
Foor
Body of Sphenoid Bone

Fig: 6

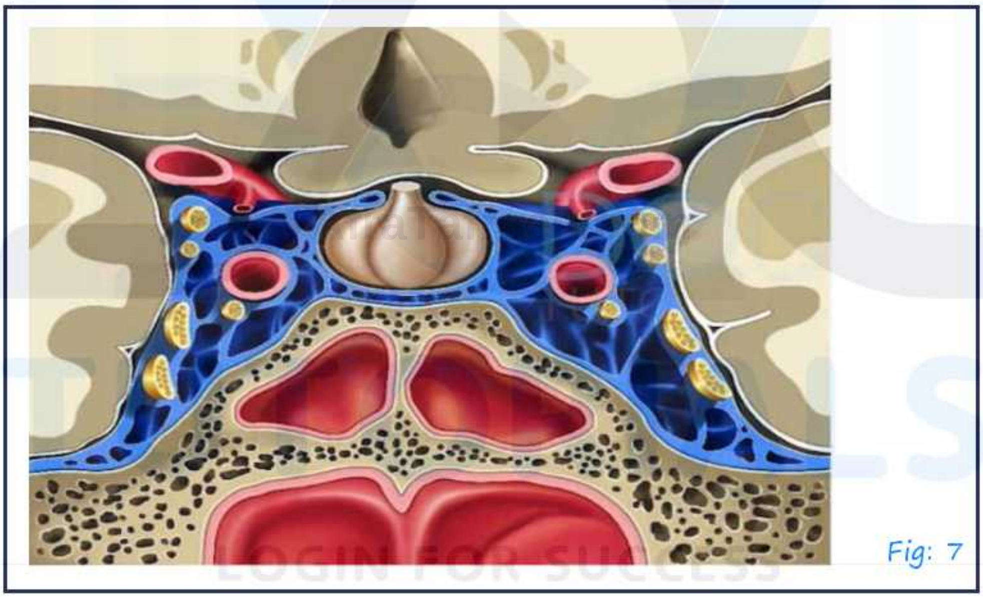
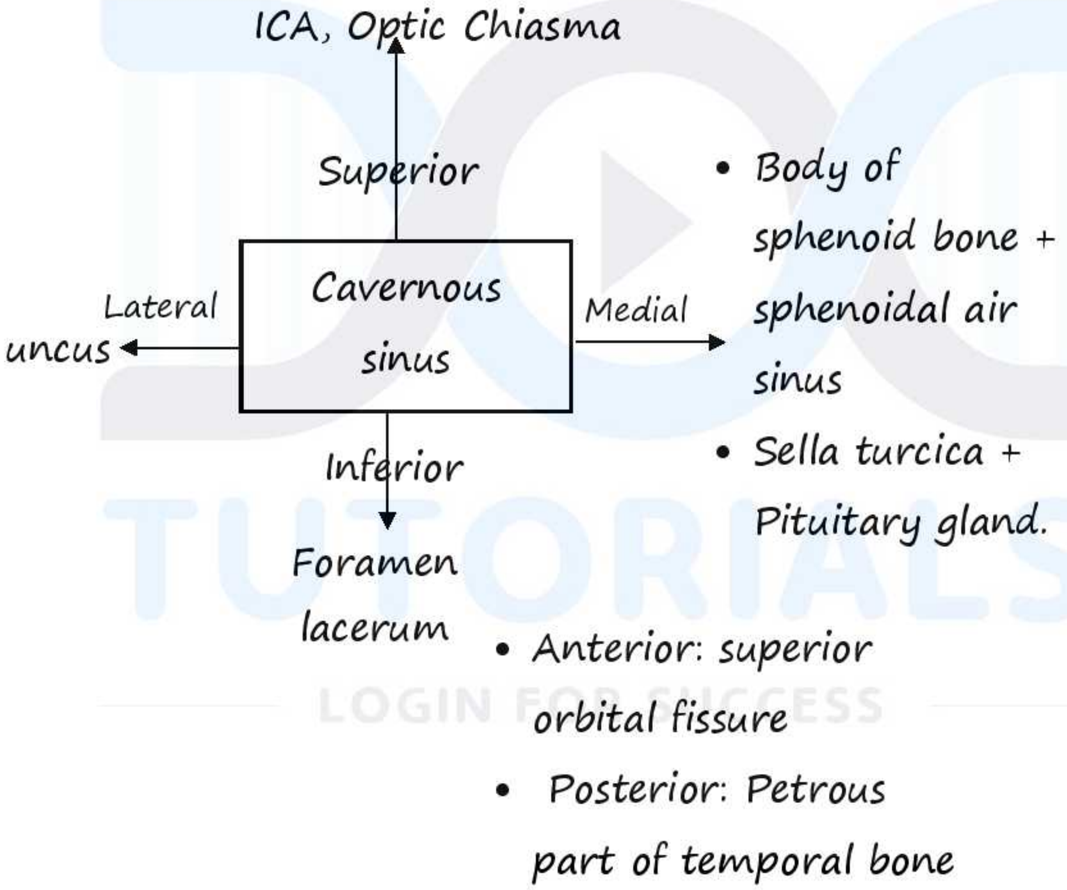


Fig: 7

- Passing through the lateral wall: of cavernous sinus III, IV and VI (Ophthalmic branch)
- Structures passing inside the cavernous sinus
  - Internal carotid artery and VI cranial nerve
- Internal carotid from the inside takes a loop and goes into the roof

Relations of cavernous sinus: 00:23:23

- Medially: Body of sphenoid bone + Sphenoidal air sinus sella turcica + Pituitary gland
- Laterally: Uncus
- Superiorly: Internal carotid artery optic chiasma
- Inferior: Foramen lacerum
- Anteriorly: Superior orbital fissure
- Posteriorly: Petrous part of temporal bone


ICA, Optic Chiasma
Superior
Cavernous sinus
Lateral
uncus
Medial
• Body of sphenoid bone + sphenoidal air sinus
• Sella turcica + Pituitary gland.
Inferior
Foramen lacerum
• Anterior: superior orbital fissure
• Posterior: Petrous part of temporal bone

DOC TUTORIALS LOGIN FOR SUCCESS

Tributaries of Cavernous Sinus 00:29:04

Orbit	Brain	Meninges
- Superior ophthalmic vein - Inferior Ophthalmic Vein - Central vein of retina	- Inferior cerebral vein - Superficial middle cerebral vein	- Sphenoparietal sinus - Middle Meningeal Sinus
Blood is taken to Cavernous sinus ↓ • Draining Channels: - Superior petrosal sinus - Inferior petrosal sinus - Superior ophthalmic vein (EMISSARY VEIN)		

- Superior ophthalmic vein is known as **Emissary vein** as it brings the blood and also helps in draining

DOC TUTORIALS
LOGIN FOR SUCCESS

TONGUE

- Muscles of the tongue
- Nerve supply of the tongue

Muscles of the tongue 00:00:28

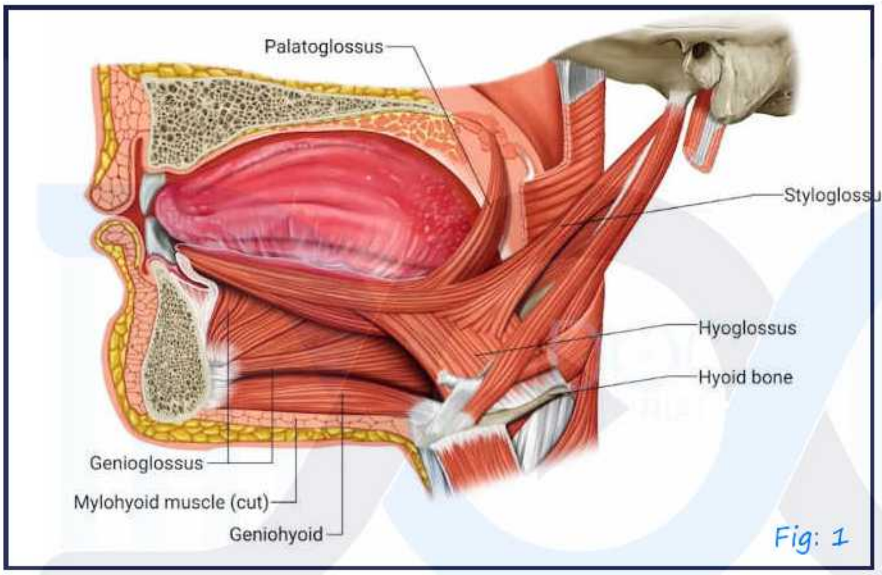

Palatoglossus
Styloglossus
Hyoglossus
Hyoid bone
Genioglossus
Mylohyoid muscle (cut)
Geniohyoid

Fig: 1

Muscles of the tongue

Intrinsic muscles
(Muscles inside the tongue)

1. Superior longitudinal muscle
2. Inferior longitudinal muscle
3. Transverse muscle
4. Vertical muscle

Extrinsic muscles
(Muscles outside the tongue)

1. Genioglossus (from mandible)
2. Styloglossus (from styloid process)
3. Hyoglossus (from hyoid bone)
4. Palatoglossus (from the palate)

TUTORIALS LOGIN FOR SUCCESS

- Largest muscle of the tongue is genioglossus.
- Safety muscle of tongue is genioglossus. It helps in the protrusion of the tongue; it prevents the tongue from falling back while lying down etc. and hence is known as the safety muscle.
- Palatoglossus is not a true muscle of the tongue as it is a muscle of the palate and also the tongue, not exclusively of the tongue.

Nerve supply of the tongue 00:06:02

Nerve supply of the tongue

Motor
(supply of the muscles)

- All muscles of tongue are supplied by XII nerve (Hypoglossal nerve) except the palatoglossus which is supplies by the Vago-Accessory Complex (VAC) or the pharyngeal plexus

Sensory

Special sensation
(Taste)

General sensation
(Temperature)

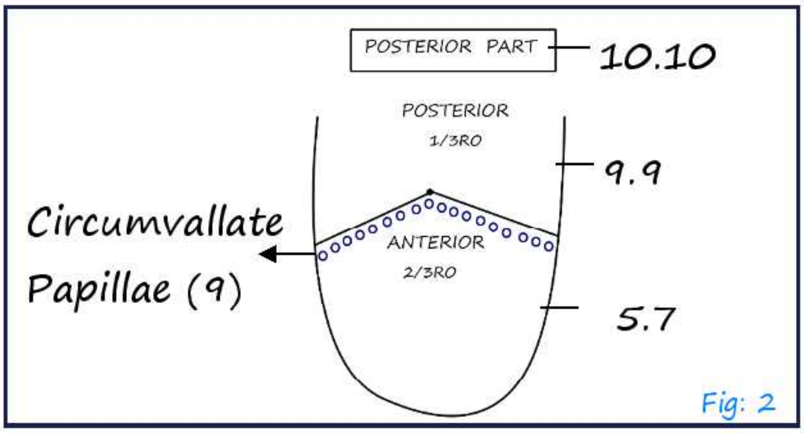


Fig: 2

- The general sensation of the anterior two-third part of the tongue is carried by 5th CN (Trigeminal Nerve) whereas the special sensation is caused by the 7th CN (Facial Nerve)
- The general and special sensations of the posterior one third is caused by 9th CN (Glossopharyngeal Nerve)
- The general and special sensations of the posterior most part of the tongue are carried by 10th CN (Vagus Nerve)

Anterior two-third of tongue 00:11:13

Anterior two-third of tongue

Special sensation (Taste) is carried by **chorda tympani branch** of the facial nerve

General sensation is carried by lingual branch which is a branch of mandibular nerve (Vth$_3$) which is in turn a branch of trigeminal nerve

- An exception is the circumvallate papillae, where the 9th CN (Glossopharyngeal Nerve) carries it

DOC TUTORIALS LOGIN FOR SUCCESS

CRANIAL NERVE – III, IV, VI

- Extra-ocular muscles are supplied by the III, IV and VI
- SO$_4$ → superior oblique by 4th CN (Trochlear Nerve)
- LR$_6$ → Lateral rectus by 6th CN (Abducens Nerve)
- Rest by 3 → Oculomotor nerve

- III and IV nerves originate from the mid brain part of the brain stem.

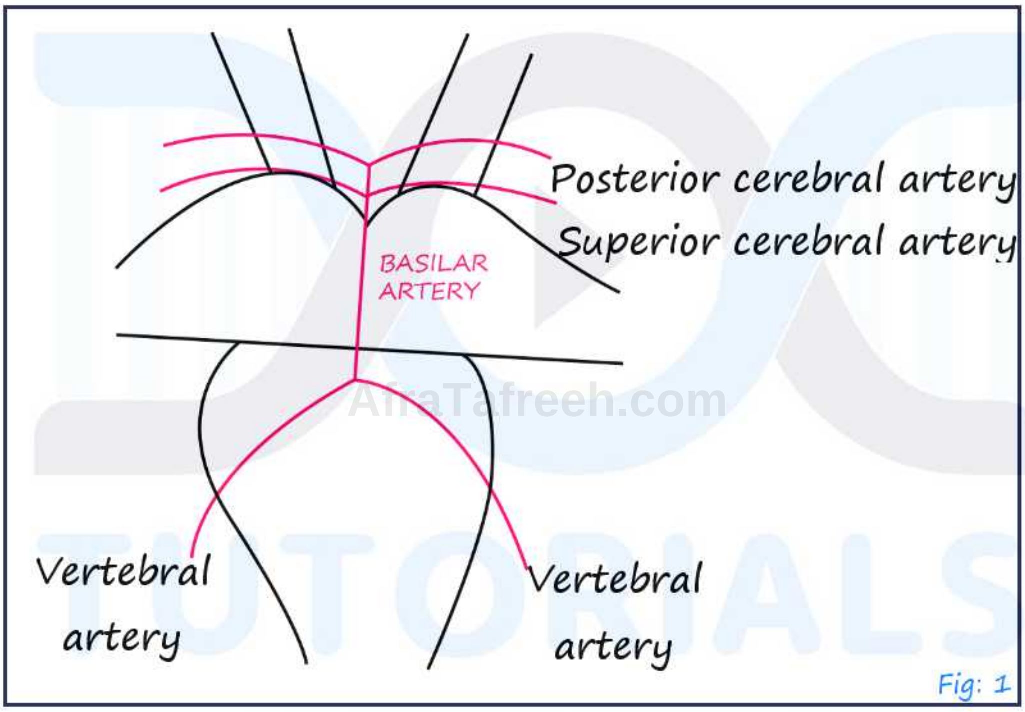

Posterior cerebral artery
Superior cerebral artery
BASILAR ARTERY
Vertebral artery
Vertebral artery

Fig: 1

- Third nerve is the content of interpeduncular fossa.
- Fourth nerve is the only cranial nerve that has dorsal origin.
- Third and fourth cranial nerves exit out between posterior cerebral artery and superior cerebellar artery.

Vertebral artery + Vertebral artery

↓

Basilar Artery

- Posterior Cerebral Artery
- Superior Cerebellar Artery

III Nerve	IV Nerve
• Origin: Ventral origin – Front of the midbrain – It is a content of INTER-PEDUNCULAR FOSSA	• Origin: Dorsal Origin – Only cranial nerve with dorsal origin form mid-brain

- Both nerves – III and IV exit between posterior cerebral artery and superior cerebellar artery.

III – Oculomotor Nerve 00:05:27

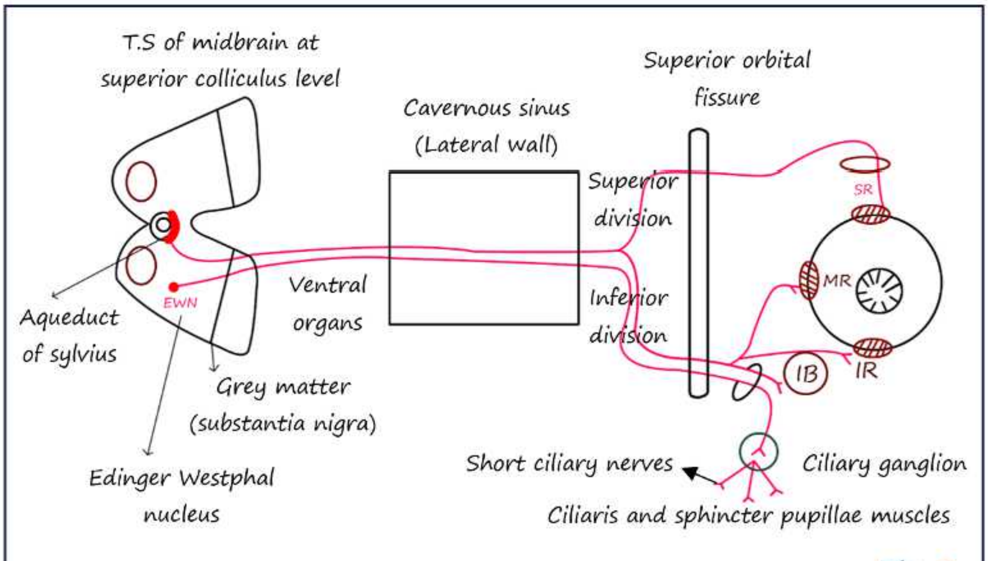

T.S of midbrain at superior colliculus level
Cavernous sinus (Lateral wall)
Superior orbital fissure
Superior division
Inferior division
SR
MR
IR
IB
EWN
Aqueduct of sylvius
Ventral organs
Grey matter (substantia nigra)
Edinger Westphal nucleus
Short ciliary nerves
Ciliary ganglion
Ciliaris and sphincter pupillae muscles

Fig: 1

- The lateral wall of cavernous sinus allows 3 nerves to pass through it:

  i. III nerve

  ii. IV nerve

  iii. Ophthalmic nerve – a branch of V nerve (Trigeminal nerve)
- No. of extra-ocular muscles → 7 (4 recti + 2 oblique + 1 LPS (Levator palpebrae superioris)
- The fibers of Edinger-Westphal nucleus go along with the inferior division of III nerve, along with the nerve to inferior oblique and end in the ciliary ganglion.

Third nerve (nucleus is merged on either side)

↓ Ventral origin

In front of mid brain

Passes through the lateral wall of cavernous sinus

↓

Divides before entering the superior orbital fissure into 2:

Superior division:
- LPS
- Superior Rectus

Inferior division:
- Medial Rectus
- Inferior Rectus
- Inferior Oblique

Parasympathetic component of third (III) Nerve

The fibers of Edinger-Westphal nucleus

↓

Travel along with the inferior division

of III nerve, along with nerve to inferior oblique.

↓

They end in ciliary ganglion

↓

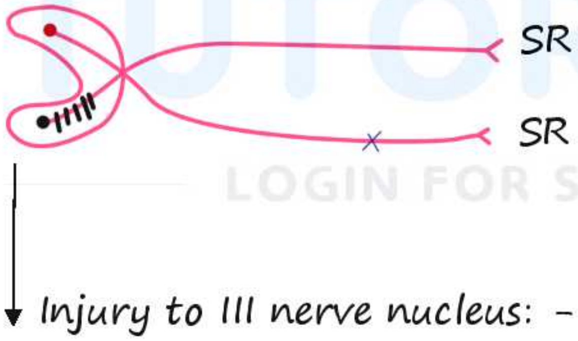
Short ciliary nerves arise from ciliary ganglion

↓

Supply to ciliaris and sphincter pupillae muscles which is concerned with the accommodation reflex along with miosis (constriction of the pupil)

Note

- III Nerve exists between the posterior cerebral artery and the superior cerebellar artery
- III nerve is most commonly involved in Intracranial aneurysms. as it is close proximity with the circle of Willis (Berry aneurysms).



Injury to III nerve nucleus: –

– Paralysis of Ipsilateral superior rectus.

Fig: 2

IV Cranial Nerve – Trochlear Nerve: 00:22:18

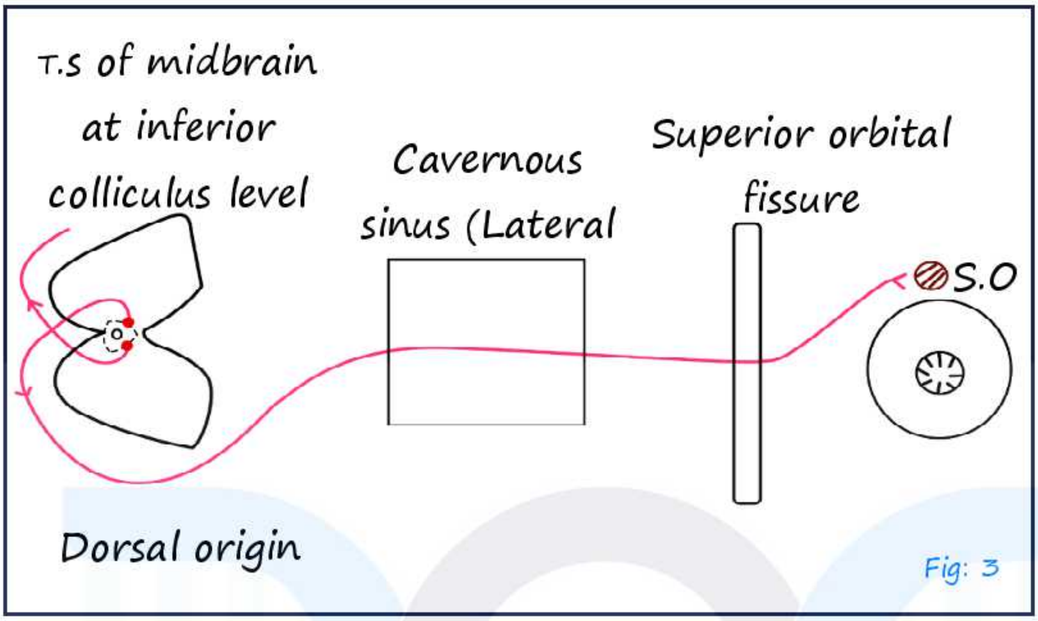

T.s of midbrain at inferior colliculus level
Cavernous sinus (Lateral
Superior orbital fissure
S.O
Dorsal origin

Fig: 3

Internal Decussation

- Note
  1. It is the only cranial nerve which has got DORSAL origin.
  2. It has got INTERNAL DECUSSATION
  3. It is the THINNEST CRANIAL NERVE (SLENDER MOST NERVE)
  4. It is also the SMALLEST CRANIAL NERVE
  5. It has got the LONGEST INTRACRANIAL COURSE.

VI Cranial Nerve – Abducens Nerve 00:28:32

- The nucleus of VI nerve is present in pons.

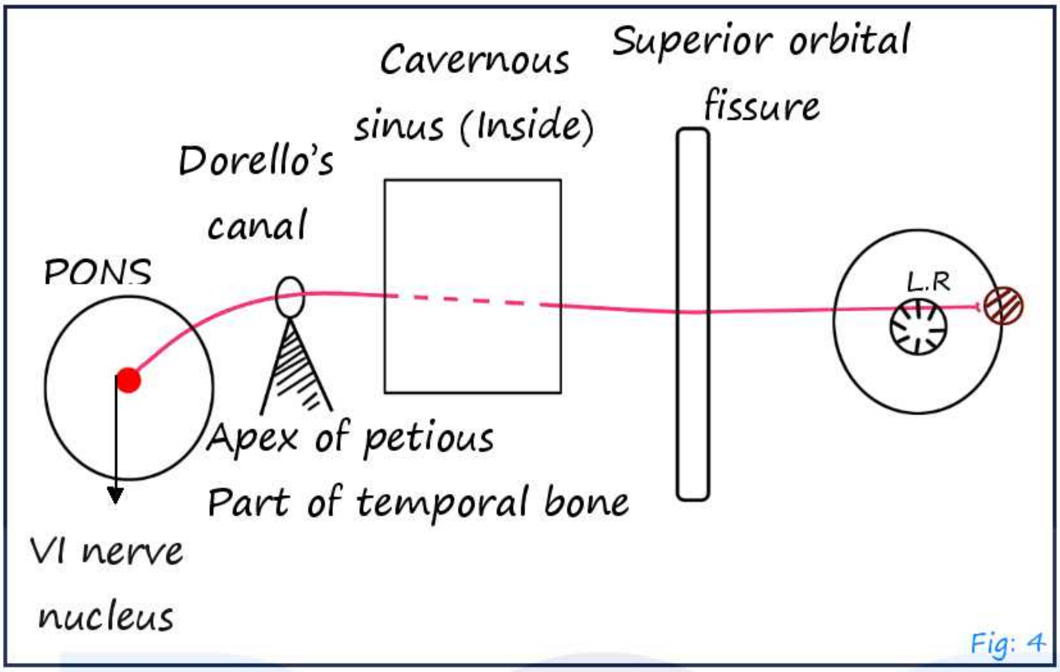

Cavernous sinus (Inside)
Superior orbital fissure
Dorello's canal
PONS
L.R
Apex of petious Part of temporal bone
VI nerve nucleus

Fig: 4

- Dorello's Canal is a ligamentous canal near the apex of the petrous part of temporal bone.

Note

1. It has the LONGEST INTRADURAL COURSE
2. It is most commonly involved in INCREASED INTRA-CRANIAL PRESSURE
3. It passes through the DORELLO'S CANAL

TUTORIALS LOGIN FOR SUCCESS

CRANIAL NERVE V PART - I

V- Trigeminal nerve 00:00:42

- Nuclei of trigeminal nerve – 4 nuclei → Sensory nuclei -3; → Motor nucleus – 1

i. Mesencephalic nucleus

ii. Chief/principal sensory nucleus

iii. Spinal nucleus

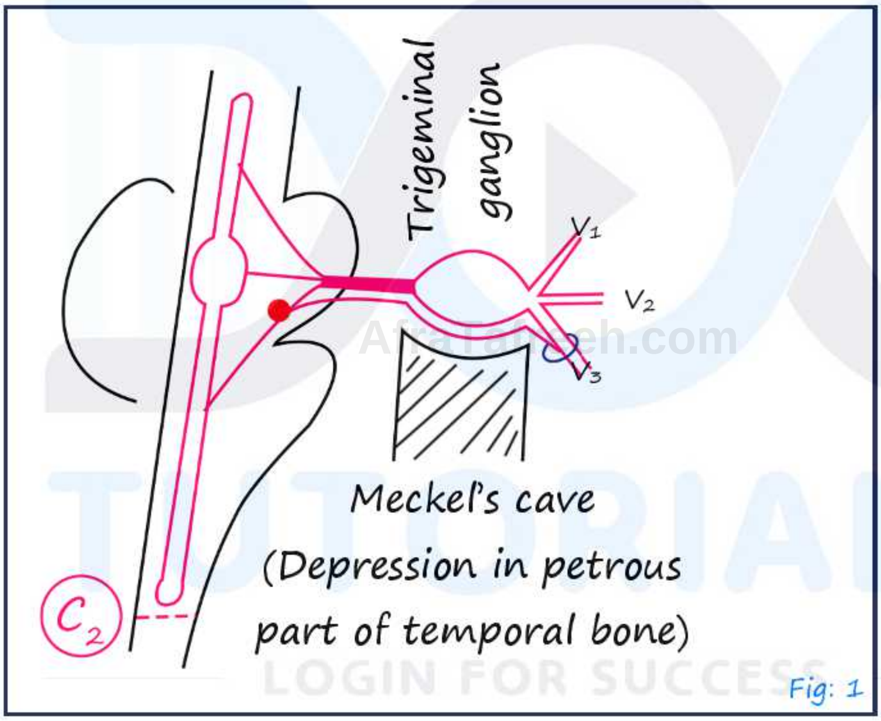

Trigeminal ganglion
V1
V2
V3
Meckel's cave
(Depression in petrous part of temporal bone)
C2

Fig: 1

V1 – Ophthalmic nerve

V2 – Maxillary nerve

V3 – Mandibular nerve

Mesencephalic Nucleus

Centre for jaw/masseteric →

Proprioceptio →

Pseudo unipolar neurons →

- Trigeminal ganglion is situated in the **MECKEL'S CAVE** – a depression in the petrous part of temporal bone.

3 Sensory nuclei

1. Mesencephalic N ← proprioception; centre for jaw/masseteric reflex; pseudo uni-polar neurons
2. Chief/principal sensory N ← Touch & pressure
3. Spinal N ← Pain & Temperature

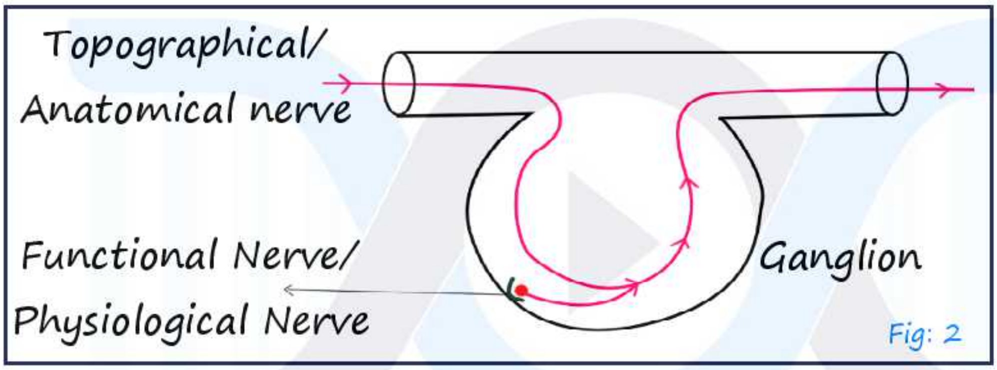

Topographical/
Anatomical nerve
Functional Nerve/
Physiological Nerve
Ganglion

Fig: 2

- Any nerve passing through the ganglion without relaying in it is known as **Topographical/Anatomical nerve.**
- Any nerve which relays and ends in the ganglion is known as **Functional/Physiological nerve**. The information is further carried by the topographical nerve.

Branches of Trigeminal Nerve 00:15:30

- V_1 → OPHTHALAMIC NERVE
- V_2 → MAXILLARY NERVE
- V_3 → MANDIBULAR NERVE

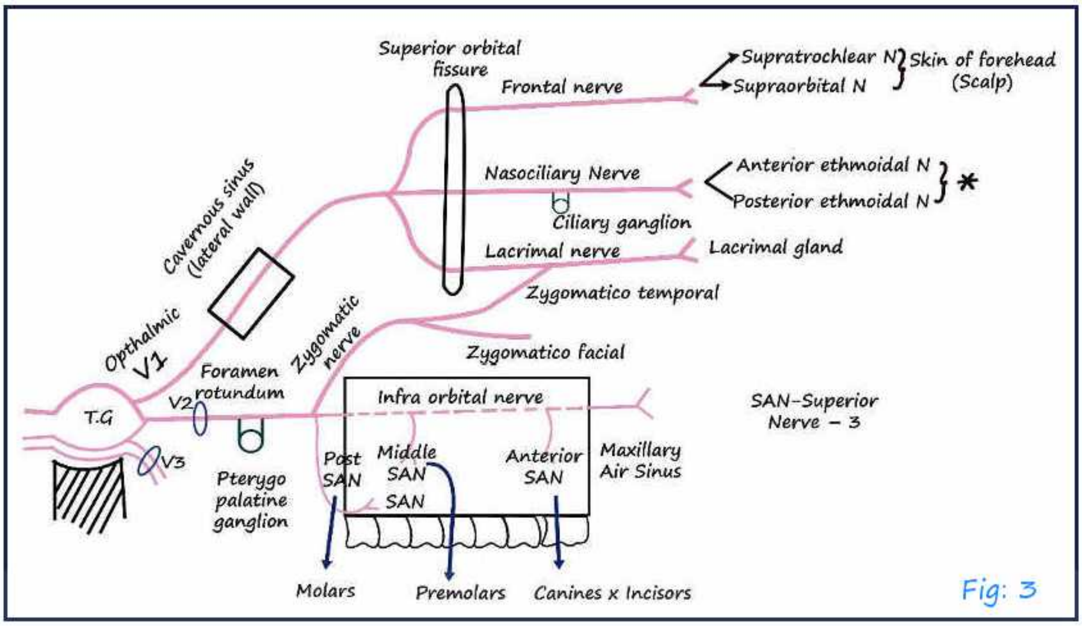

Superior orbital fissure
Frontal nerve
Supratrochlear N
Supraorbital N
Skin of forehead (Scalp)
Nasociliary Nerve
Anterior ethmoidal N
Posterior ethmoidal N
*
Ciliary ganglion
Lacrimal nerve
Lacrimal gland
Cavernous sinus (lateral wall)
Zygomatico temporal
Opthalmic
V1
Zygomatic nerve
Zygomatico facial
Foramen rotundum
T.G
V2
V3
Infra orbital nerve
SAN-Superior Nerve - 3
Pterygo palatine ganglion
Post SAN
Middle SAN
SAN
Anterior SAN
Maxillary Air Sinus
Molars
Premolars
Canines x Incisors

Fig: 3

TUTORIALS
LOOK FOR SUCCESS

- Nasociliary nerve passes through the ciliary ganglion → **Topographical nerve**
- Ophthalmic nerve before entering the superior orbital fissure divides into 3 branches: -

  1. Frontal N
  2. Nasociliary N
  3. Lacrimal N

- Nasociliary nerve [AEN / PEN] Dura matter of anterior cranial fossa

↓

- Nasal cavity
- Ethmoidal air sinus
- Sphenoidal air sinus

↓

AEN exists as **EXTERNAL NASAL BRANCH**

↓

Skin over tip of nose

- Maxillary nerve passes through pterygopalatine ganglion → Topographical nerve

- Maxillary nerve
  - Zygomatic N
    - Zyg. temporal + Lacrimal N
    - Zyg. facial
  - Infra orbital nerve
    - Anterior superior Alveolar (Canines, incisors)
    - Middle superior Alveolar N (premolars)
  - direct branch: Posterior superior Alveolar Nerve → Molars

CRANIAL NERVE V PART – II

Mandibular Nerve – V_3 [Third branch of Trigeminal Nerve] 00:00:07

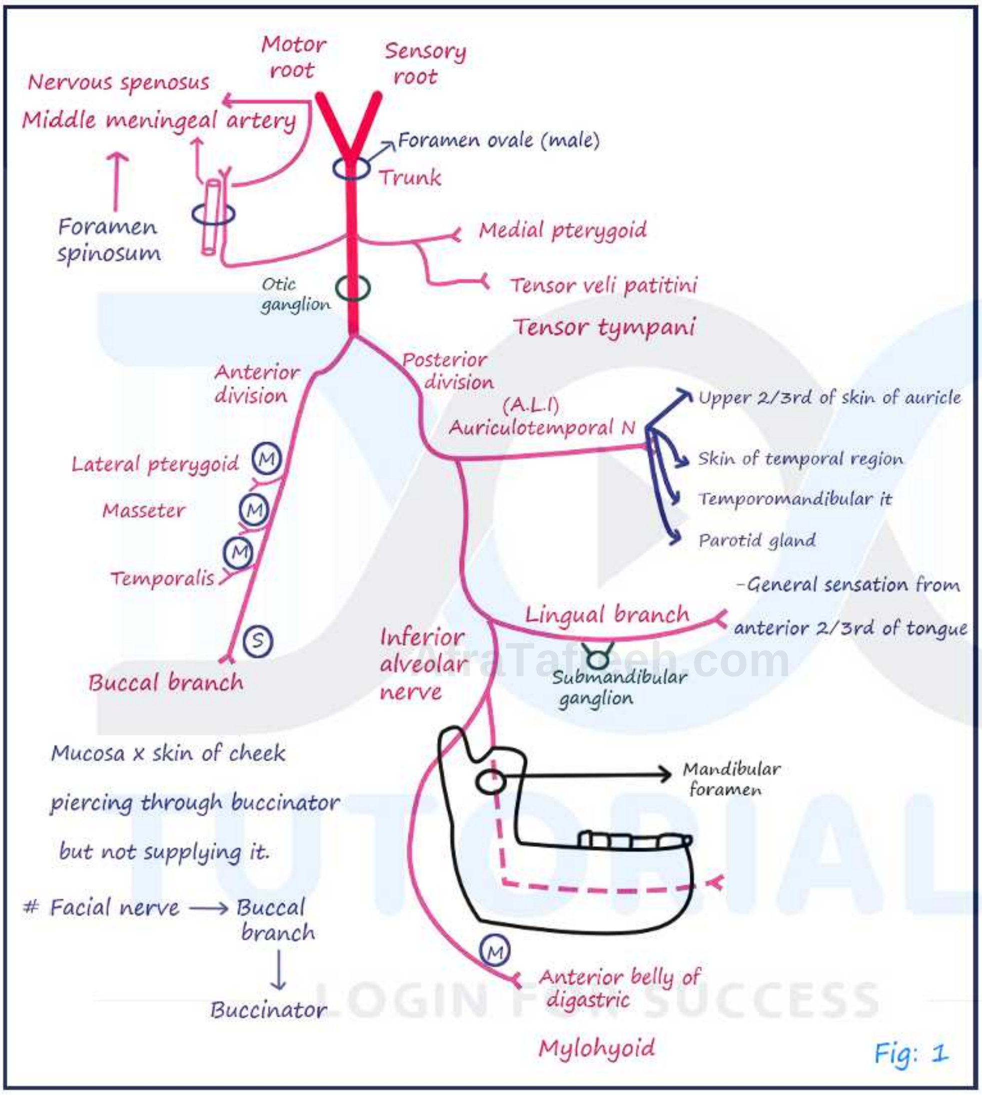

Motor root
Sensory root
Nervous spenosus
Middle meningeal artery
Foramen ovale (male)
Trunk
Foramen spinosum
Medial pterygoid
Otic ganglion
Tensor veli patitini
Tensor tympani
Anterior division
Posterior division
(A.L.I)
Auriculotemporal N
Upper 2/3rd of skin of auricle
Skin of temporal region
Temporomandibular jt
Parotid gland
Lateral pterygoid
M
Masseter
M
M
Temporalis
S
Buccal branch
-General sensation from
Lingual branch
anterior 2/3rd of tongue
Inferior alveolar nerve
Submandibular ganglion
Mandibular foramen
Mucosa x skin of cheek
piercing through buccinator
but not supplying it.
# Facial nerve → Buccal branch
↓
Buccinator
M
Anterior belly of digastric
Mylohyoid

Fig: 1

Trunk

- Nervous spinosus ← branch of the trunk of mandibular nerve

  ↓

  Chief nerve supplying dura-matter
- Chief artery and chief nerve to dura matter pass through

Foramen spinosum (middle meningeal artery & nervous spinosus)

- Rupture of middle meningeal artery → Epidural/extradural haemorrhage.
- Out of the 4 muscles of mastication, Medial Pterygoid is the only muscle of mastication supplied by the trunk.
- Trunk → Nerve to medial pterygoid → Tensor veli palatine, → Tensor tympanic
- Otic ganglion is medial to the trunk.
- 4 muscles of mastication: -
  - i. Medial pterygoid ← Trunk of the mandibular nerve.
  - ii. Lateral pterygoid
  - iii. Masseter
  - iv. Temporalis

ii–iv ← Anterior division

↓

Buccal branch (sensory branch)

- Buccal branch → Mucosa and skin of cheek piercing through **Buccinator muscle**, but not supplying it.

  ↓

  Supplied by the Facial nerve → Buccal branch → Buccinator muscle
- Inferior Alveolar nerve passes through **Mandibular foramen**

- Muscles which are not the muscles of mastication, but are supplied by mandibular nerve – 4
  1 – Tensor veli palatini
  2 – Tensor tympani
  3 – Anterior belly of digastric
  4 – Mylohyoid
- Mandibular nerve supplies to first pharyngeal arch.

FACIAL NERVE

VII CN – Facial Nerve

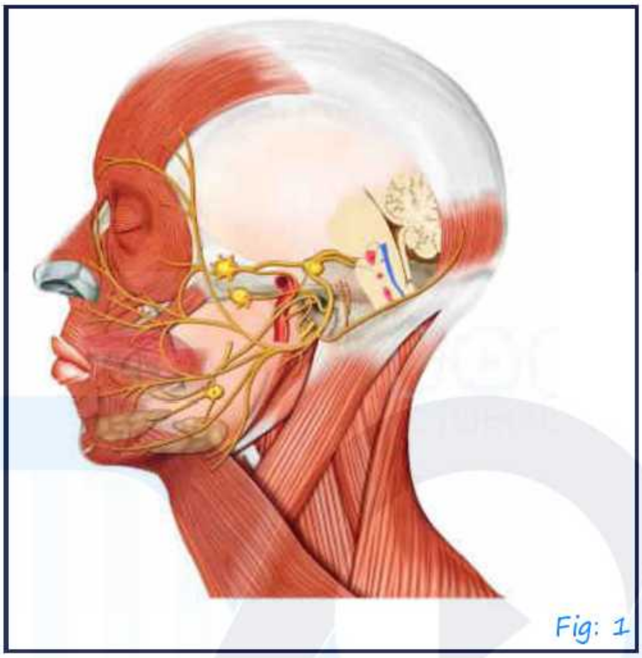


Fig: 1

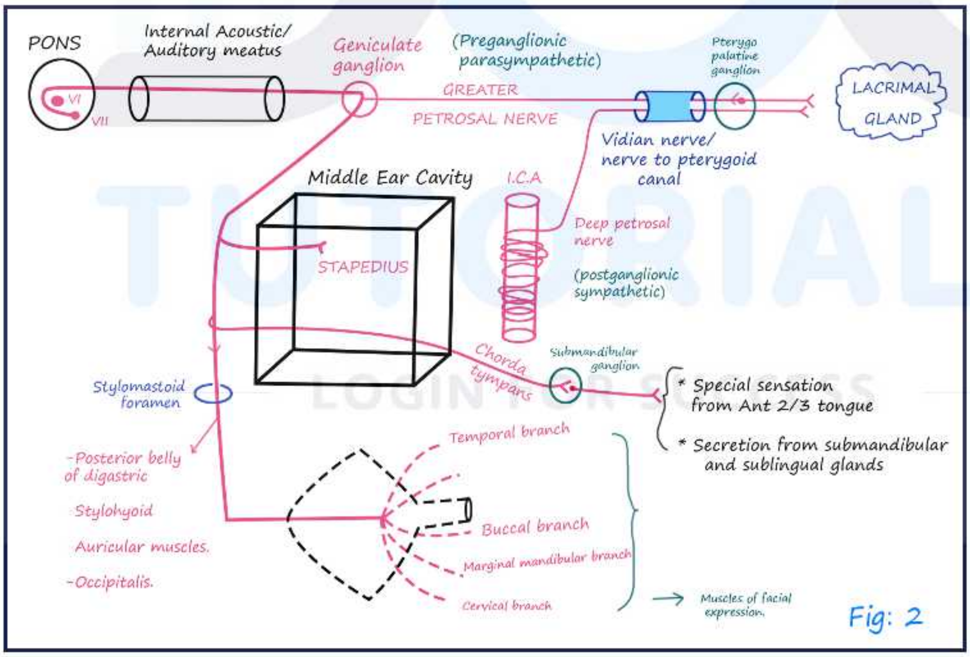

PONS
VI
VII
Internal Acoustic/ Auditory meatus
Geniculate ganglion
(Preganglionic parasympathetic)
GREATER
PETROSAL NERVE
Pterygo palatine ganglion
LACRIMAL GLAND
Vidian nerve/ nerve to pterygoid canal
Middle Ear Cavity
I.C.A
STAPEDIUS
Deep petrosal nerve
(postganglionic sympathetic)
Chorda tympani
Submandibular ganglion
* Special sensation from Ant 2/3 tongue
* Secretion from submandibular and sublingual glands
Stylomastoid foramen
-Posterior belly of digastric
Stylohyoid
Auricular muscles.
-Occipitalis.
Temporal branch
Buccal branch
Marginal mandibular branch
Cervical branch
Muscles of facial expression.

Fig: 2

- Facial nerve nucleus is more anterior (nearer to the Trigeminal nucleus) → Because of Neurobiotaxis, seventh nerve takes a turn around the sixth nucleus.
- Facial Colliculus → elevation on the dorsal surface of pons → Reason

  - 6th Nucleus
  - 7th Nerve
- VIDIAN NERVE/Nerve to pterygoid canal = Greater petrosal nerve + Deep petrosal Nerve
- Muscles supplied by Facial nerve but are not the muscles of facial expression:
  1. Posterior belly of digastric
  2. Stylohyoid
  3. Auricular muscles
  4. Occipitalis

Parasympathetic/Secretomotor Pathways

00:26:9

- LN-Lacrimatory nucleus is a part of SSN which is going to supply the lacrimal gland.

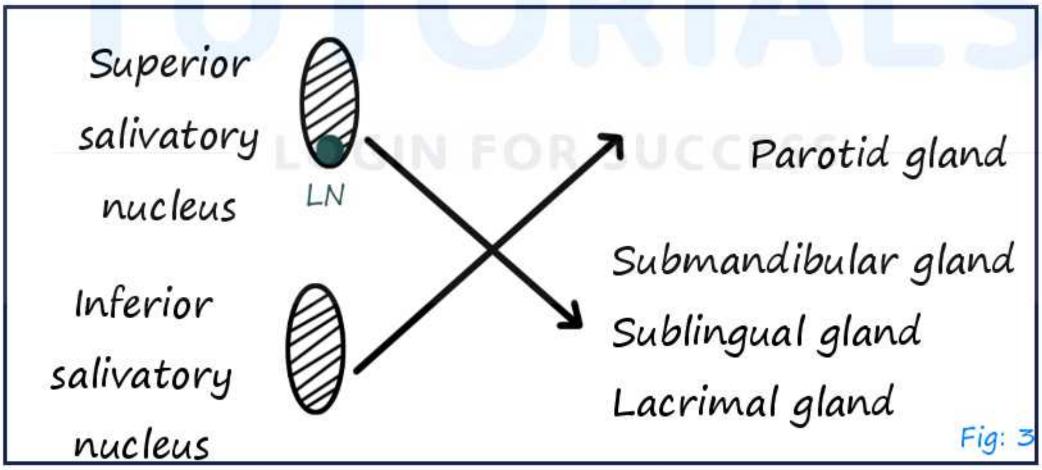

Superior salivatory nucleus
LN
Inferior salivatory nucleus
Parotid gland
Submandibular gland
Sublingual gland
Lacrimal gland

Fig: 3

Secretomotor Pathway to Lacrimal Gland

00:28:42

DOC TUTORIALS
LOGIN FOR SUCCESS

Superior Salivatory Nucleus
(Lacrimatory Nucleus)
↓
Facial Nerve (VII) — Functional Nerve
↓
Greater Petrosal Nerve
↓
Pterygopalatine Ganglion
↓
Maxillary Nerve (V_2)
↓
Zygomatic Nerve — Topographical Nerve
↓
Zygomaticotemporal Nerve
↓
Lacrimal Nerve
↓
Lacrimal Gland

Parasympathetic/Secretomotor Pathway to Submandibular and Sublingual Pathway:

00:31:48

Superior Salivatory Nucleus
↓
Facial Nerve
↓
Chorda tympani branch
↓
Submandibular ganglion
↓
Lingual Nerve
(Branch of posterior division of Mandibular nerve)

↓

Submandibular and Sublingual glands

Secretomotor Pathway to Parotid Gland

00:33:57

Inferior Salivatory Nucleus

↓

Glossopharyngeal nerve (IX)

↓

Jacobson's nerve

↓

Tympanic plexus (Middle ear cavity)

↓

Lesser petrosal nerve

↓

Otic ganglion

↓

Mandibular nerve (V_3)

↓

Posterior division

↓

Auriculotemporal nerve

↓

parotid nerve

Parasympathetic Ganglion 00:37:45

	Topographical Nerve	Functional Nerve
1. Ciliary Ganglion	Nasociliary nerve	Oculomotor nerve
2. Pterygopalatine ganglion	Maxillary nerve	Greater petrosal nerve

3. Otic ganglion	Mandibular nerve (trunk)	Lesser petrosal nerve
4. Submandibular ganglion	Lingual nerve	Chorda tympani Branch of Facial nerve

CARNIAL NERVES - IX, X, XI, XII

(ANSA CERVICALIS)

IX CN – Glossopharyngeal Nerve 00:00:37

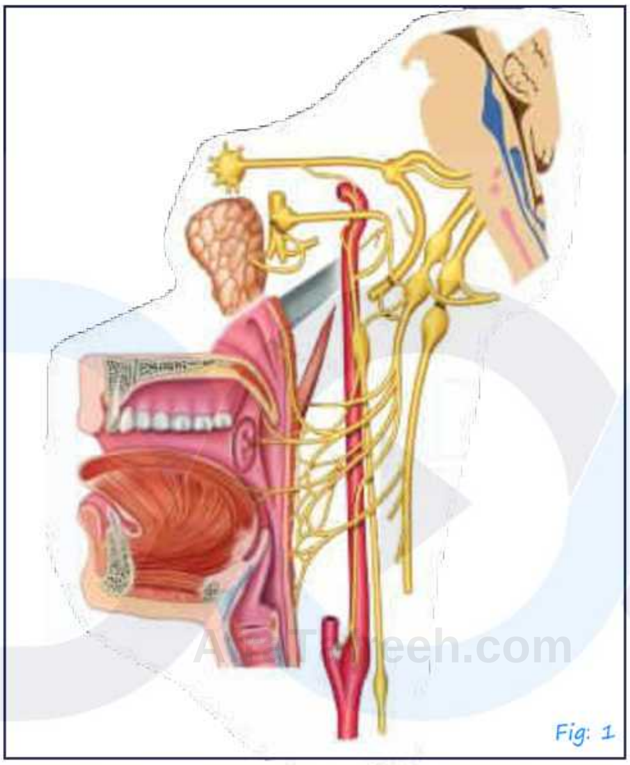


Fig: 1

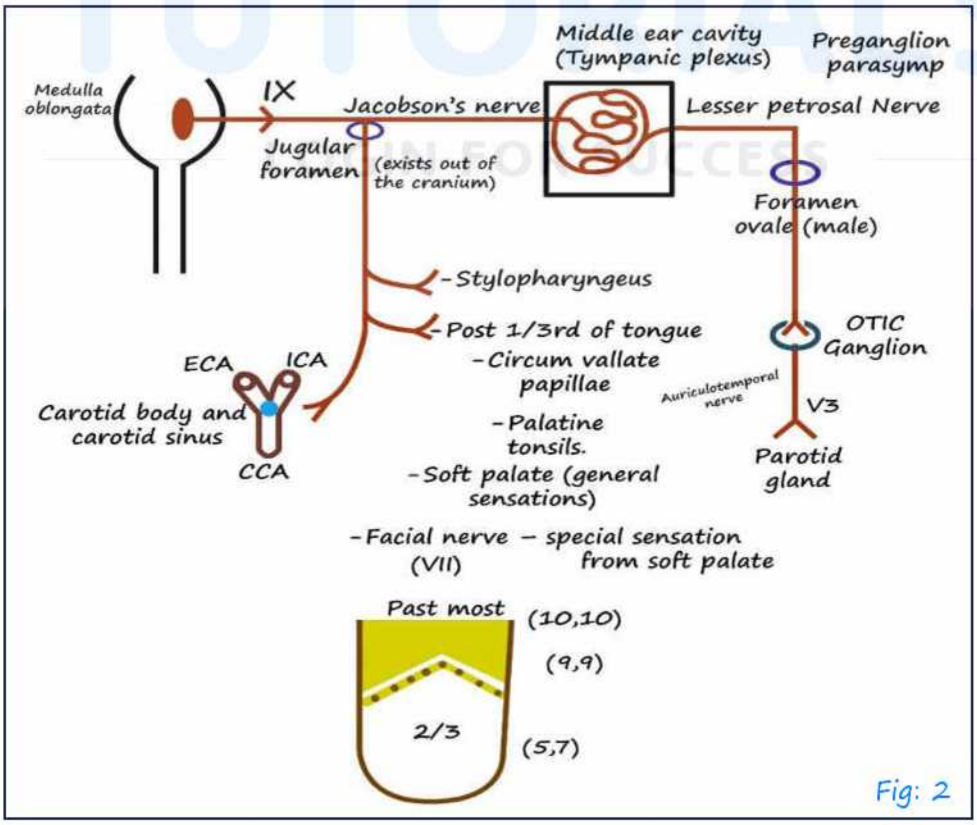

Medulla oblongata
IX
Jacobson's nerve
Jugular foramen
(exists out of the cranium)
Middle ear cavity (Tympanic plexus)
Preganglion parasymp
Lesser petrosal Nerve
Foramen ovale (male)
OTIC Ganglion
Auriculotemporal nerve
V3
Parotid gland
-Stylopharyngeus
-Post 1/3rd of tongue
-Circum vallate papillae
-Palatine tonsils.
-Soft palate (general sensations)
-Facial nerve (VII) – special sensation from soft palate
ECA
ICA
Carotid body and carotid sinus
CCA
Past most
(10,10)
(9,9)
2/3
(5,7)

Fig: 2

- The IX CN comes out of the cranium also via Jugular Foramen (Along with X and XI)
- IX, X and XI exit out of jugular foramen
- Carotid body and carotid sinus are present at the bifurcation of the common artery and internal carotid artery.
- The information from the chemoreceptors and baroreceptors in the carotid body and carotid sinus is carried by a branch of the IX nerve → Nerve of Hearing
- All the salivary glands except Parotid gland is supplied by VII CN.
- The parotid gland is supplied by IX CN – Glossopharyngeal nerve
- The branch of IX nerve contributing to the tympanic plexus in the middle ear cavity is known as JACOBSON's NERVE.
- The lesser petrosal nerve also exists from the cranium through the foramen ovale (Male).
- Lesser petrosal nerve is preganglionic parasympathetic and it ends in the OTIC ganglion.
- The information from the otic ganglion is carried by the topographical/anatomical nerve → Auriculotemporal nerve (V3) → Parotid gland
- IX CN → Jacobson's nerve → Tympanic plexus → Lesser petrosal nerve → Otic ganglion → Auriculotemporal nerve (V3) → Parotid gland

X CN – Vagus Nerve 00:14:09

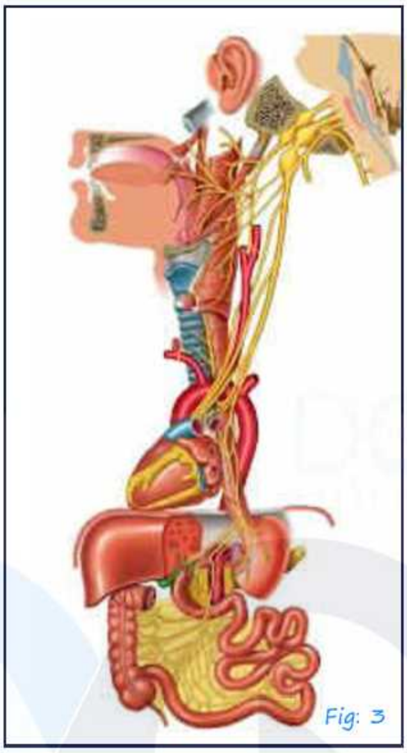


Fig: 3

- All the muscles of the larynx are present inside the larynx except one muscle which is present outside the larynx between the cricoid and thyroid cartilage → Cricothyroid muscle
- Vagus nerve
  - SLN (Superior laryngeal nerve → ILN & ELN
  - RLN (recurrent laryngeal nerve)
  - Supplies to: Larynx
    Pharynx
    Palate

DOI TUTORIALS
LOGIN FOR SUCCESS

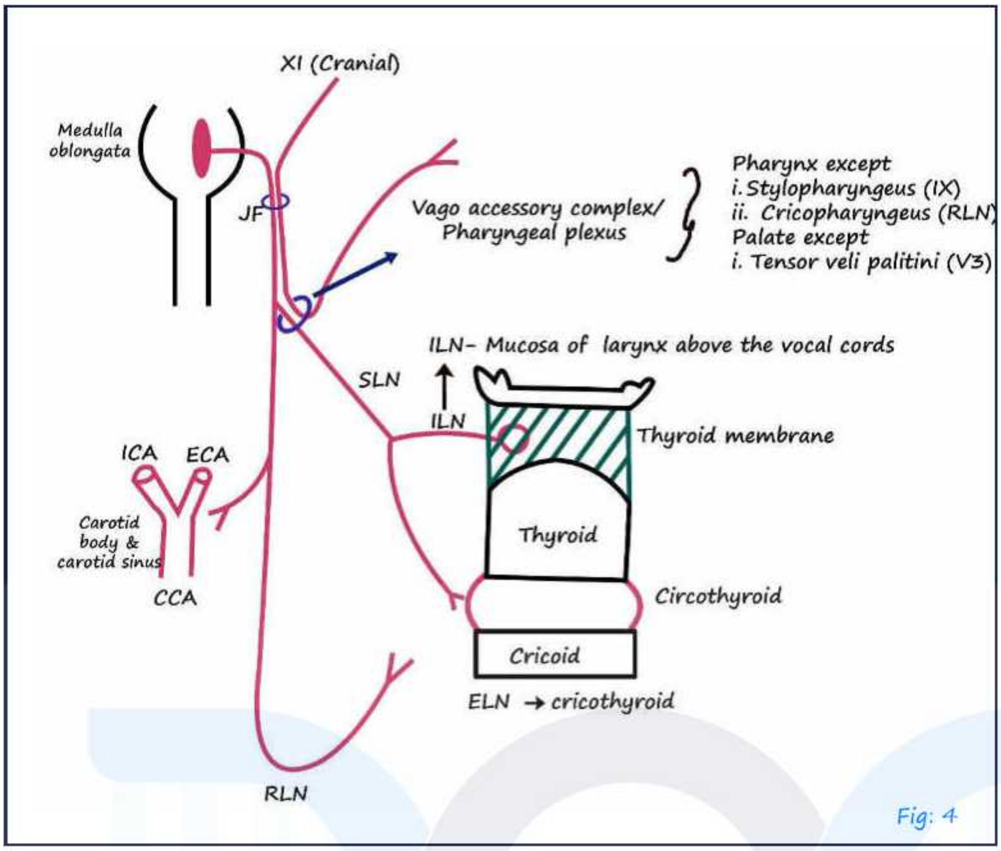

XI (Cranial)
Medulla oblongata
JF
Vago accessory complex/ Pharyngeal plexus
Pharynx except
i. Stylopharyngeus (IX)
ii. Cricopharyngeus (RLN)
Palate except
i. Tensor veli palitini (V3)
ILN– Mucosa of larynx above the vocal cords
SLN
ILN
Thyroid membrane
ICA
ECA
Carotid body & carotid sinus
CCA
Thyroid
Circothyroid
Cricoid
ELN → cricothyroid
RLN

Fig: 4

- All muscles of larynx except cricothyroid
- Mucosa of larynx below vocal cords
- One muscle of pharynx – Cricopharyngeus
- Carotid body and carotid sinus have chemoreceptors and baroreceptors which are concerned with the regulation of blood pressure (BP) and regulation of respiration

XI CN – Accessory Nerve 00:28:22

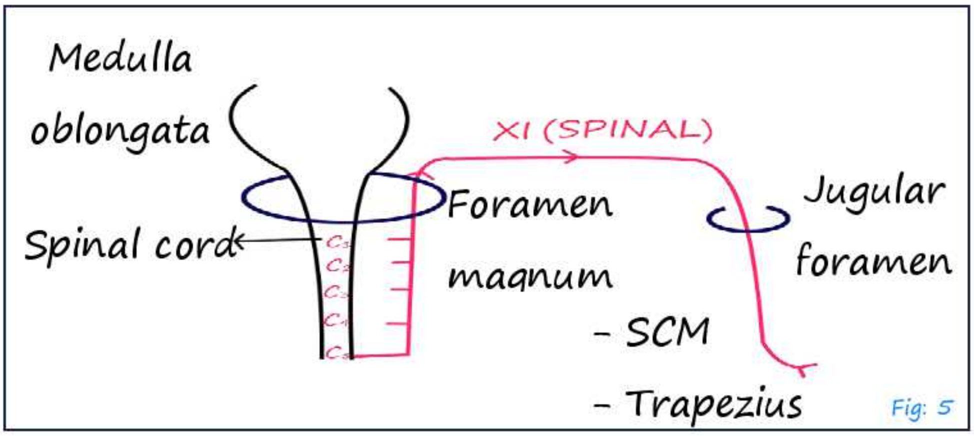

Medulla oblongata
XI (SPINAL)
Foramen magnum
Jugular foramen
Spinal cord
C1
C2
C3
C4
C5
- SCM
- Trapezius

Fig: 5

- Spinal accessory nerve enters the cranium via foramen magnum and exists out via jugular foramen
- XI (Spinal) passes through two foramens

Foramen Magnum (Entry)	Jugular Foramen (Exit)

- Supplies to: 1. Sternocleidomastoid
  2. Trapezius

XII CN – Hypoglossal Nerve 00:28:22

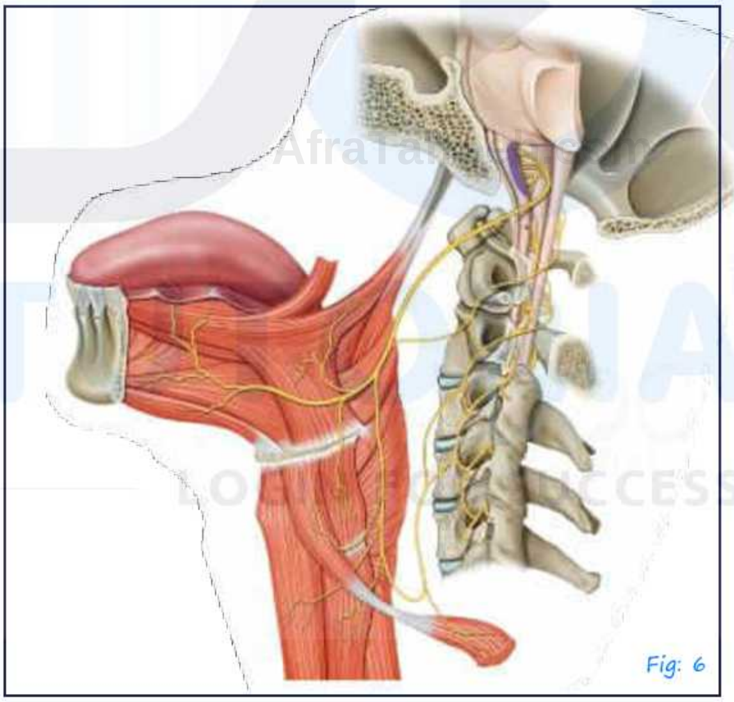


Fig: 6

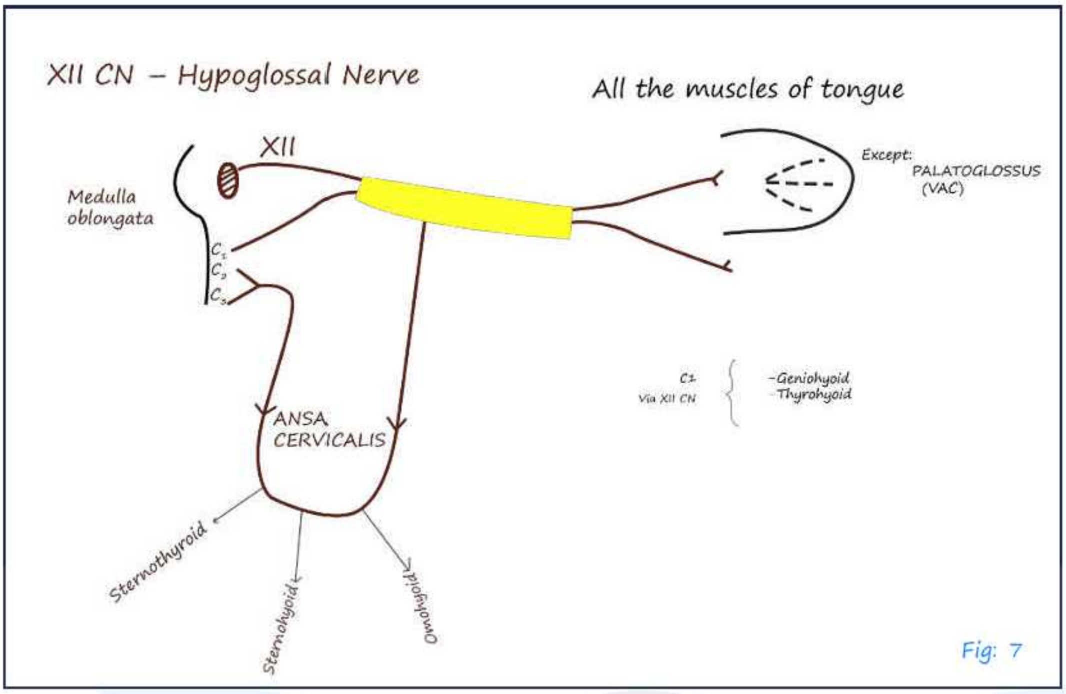

XII CN – Hypoglossal Nerve
All the muscles of tongue
XII
Medulla oblongata
C1
C2
C3
Except: PALATOGLOSSUS (VAC)
C1 Via XII CN
-Geniohyoid
-Thyrohyoid
ANSA CERVICALIS
Sternothyroid
Sternohyoid
Omohyoid

Fig: 7

- XII goes through the hypoglossal canal and supplies to the muscles of the tongue
- The Geniohyoid and thyrohyoid are supplied by C1 via the hypoglossal nerve
- Ansa cervicalis: 1. Sternothyroid
  2. Sternohyoid
  3. Omohyoid
- Strap muscles: Infrahyoid muscles (Below the hyoid bone)

  1.Sternothyroid

  2.Sternohyoid

  3.Omohyoid

  4.Thyrohyoid
- Ansa cervicalis supplies all the strap muscles except the thyrohyoid muscle (C1 via XII CN)

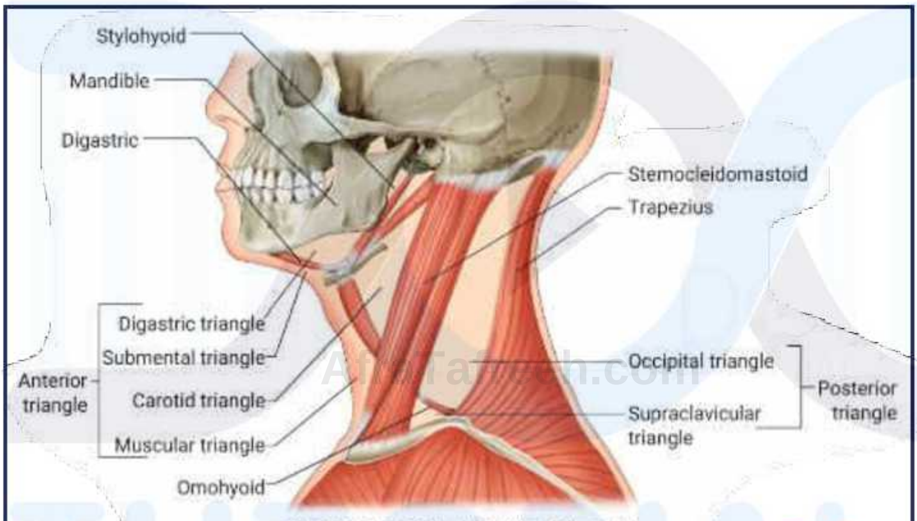
TUTORIALS LOGIN FOR SUCCESS

POSTERIOR TRIANGLE OF NECK

Sternocleidomastoid Muscle 00:00:29

- Origin: - Sternal head
  Clavicular head
- Insertion – Mastoid

Posterior Triangle of Neck 00:01:58


Stylohyoid
Mandible
Digastric
Sternocleidomastoid
Trapezius
Anterior triangle
Digastric triangle
Submental triangle
Carotid triangle
Muscular triangle
Omohyoid
Occipital triangle
Supraclavicular triangle
Posterior triangle

The triangles of the left side of the neck

Fig: 1

Boundaries

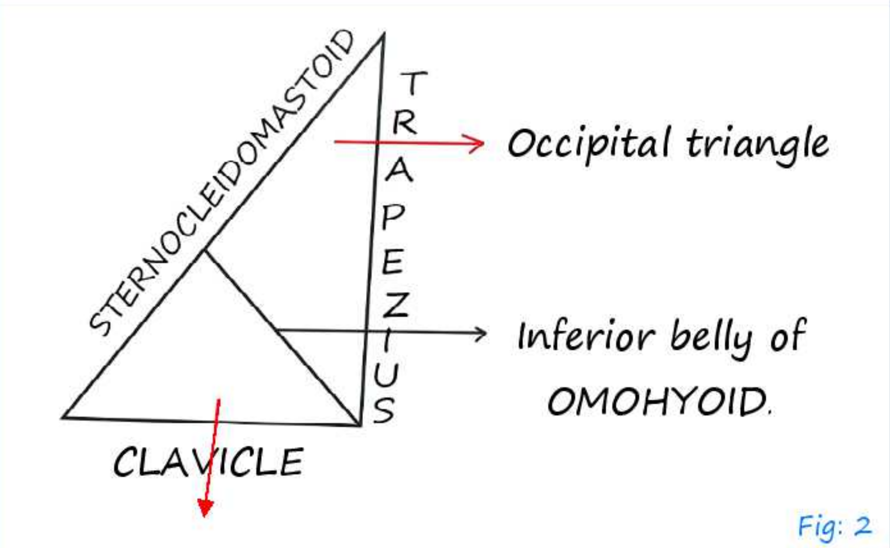
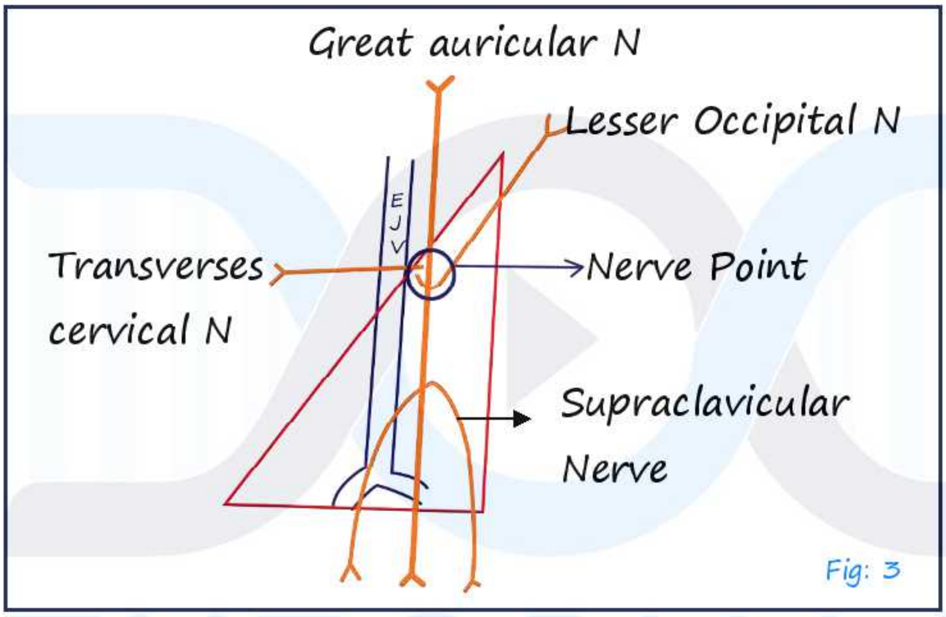

STERNOCLEIDOMASTOID
TRAPEZIUS
Occipital triangle
Inferior belly of OMOHYOID.
CLAVICLE

Fig: 2

Supraclavicular Triangle/Subclavian triangle (as subclavian vessels pass through this triangle).

Roof

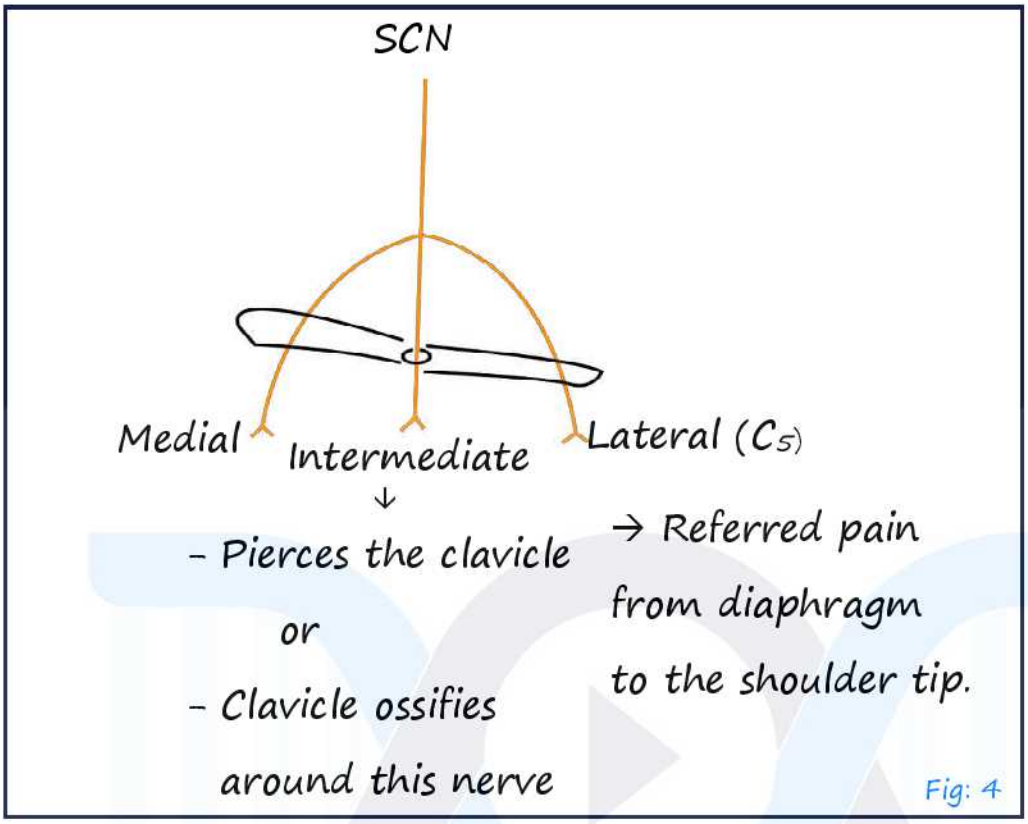
- External jugular vein
- 4 cutaneous nerves


Great auricular N
Lesser Occipital N
E J V
Transverses cervical N
Nerve Point
Supraclavicular Nerve
Fig: 3

Great Auricular Nerve

- Travels along with external jugular vein.
- Supplies to skin at angle of mandible.
- Supplies to lobule of ear.
- Frey's Syndrome – Regenerating Auriculotemporal nerve joins with great auricular nerve.

Supraclavicular Nerve


SCN
Medial
Intermediate
Lateral (C_5)

Intermediate ↓

- Pierces the clavicle

or

- Clavicle ossifies around this nerve

Lateral → Referred pain from diaphragm to the shoulder tip.

Fig: 4

Supraclavicular space

- External jugular vein
- Supraclavicular nerves

Floor

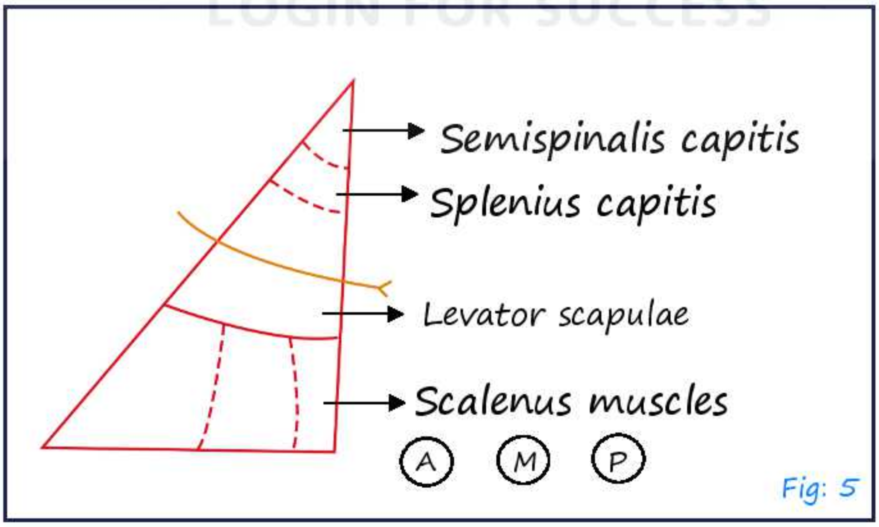

Semispinalis capitis
Splenius capitis
Levator scapulae
Scalenus muscles
Ⓐ Ⓜ Ⓟ

Fig: 5

- Levator scapulae → has the largest contribution.

- Spinal accessory nerve → runs over levator scapulae and supplies sternocleidomastoid and the trapezius muscle.
- Brachial plexus goes in between the scalenus muscles.

Contents

i. Spinal accessory nerve (XI)
ii. Brachial plexus (Trunks)
iii. Subclavian vessels
iv. Roof Structures
v. Occipital artery – branch of external carotid artery

ANTERIOR TRIANGLE OF NECK

Boundaries of Anterior Triangle – 4 triangles

00:00:27

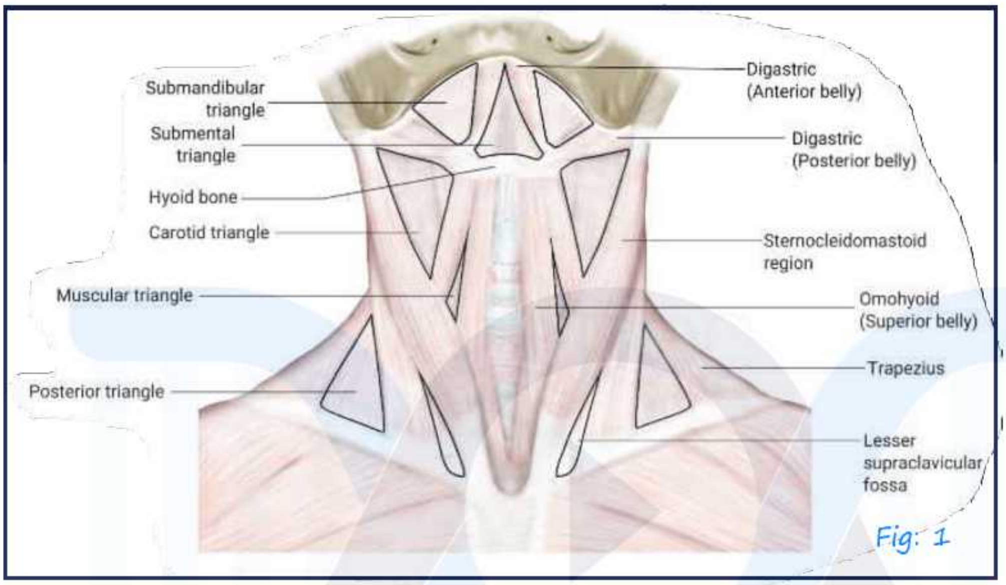

Submandibular triangle
Submental triangle
Hyoid bone
Carotid triangle
Muscular triangle
Posterior triangle
Digastric (Anterior belly)
Digastric (Posterior belly)
Sternocleidomastoid region
Omohyoid (Superior belly)
Trapezius
Lesser supraclavicular fossa

Fig: 1

BOUNDARIES

- Midline of the neck
- Sternocleidomastoid
- Mandible

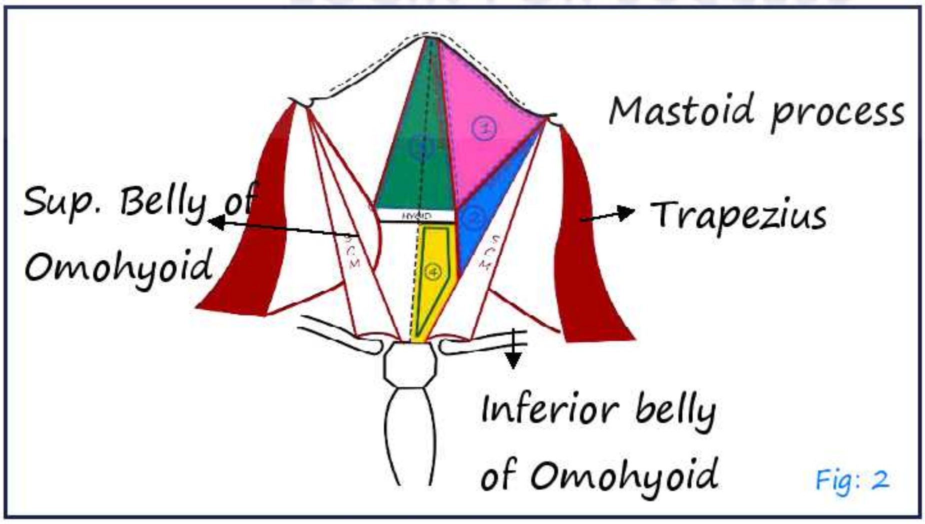

Mastoid process
Trapezius
Sup. Belly of Omohyoid
Inferior belly of Omohyoid
HYOID
SCM
SCM
①
②
③
④

Fig: 2

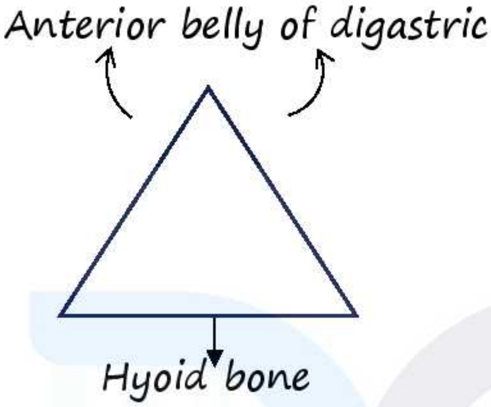
i. Digastric/Submandibular triangle

ii. Carotid triangle

iii. Submental triangle

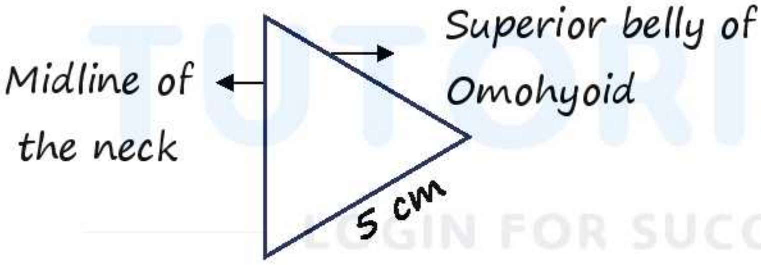
iv. Muscular triangle

Submental triangle


Anterior belly of digastric
Hyoid bone

- Contents
  - Submental lymph nodes

Muscular triangle


Superior belly of Omohyoid
Midline of the neck
5 cm

- Contents
  - Sternothyroid ⎤
  - Sternohyoid ⎦ STRAP muscle

DOC TUTORIALS
LOGIN FOR SUCCESS

CAROTID TRIANGLE OF NECK

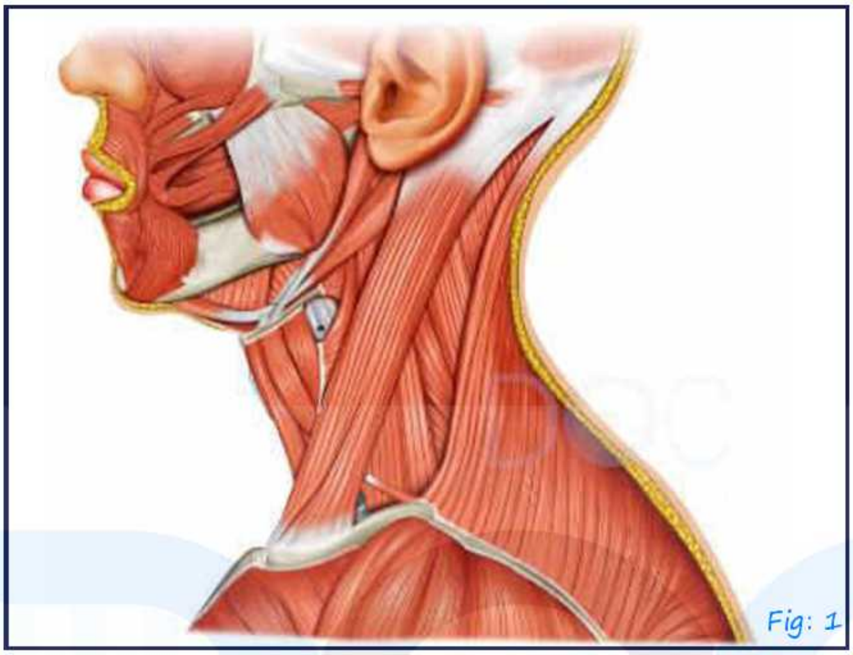
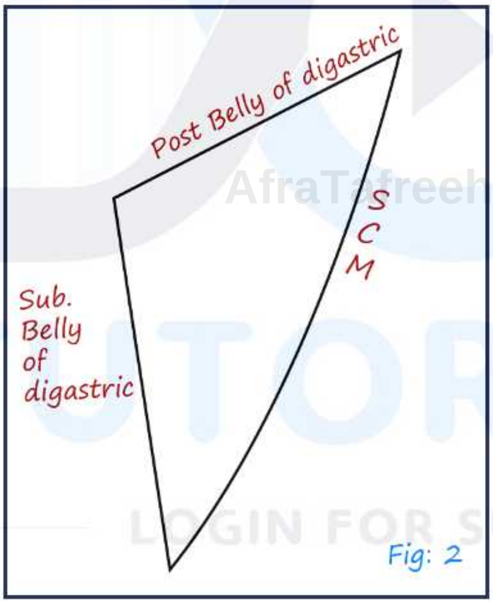


Fig: 1


Post Belly of digastric
S C M
Sub. Belly of digastric
Fig: 2

- Posterior belly of digastric
- Sternocleidomastoid
- Superior belly of Omohyoid

Floor

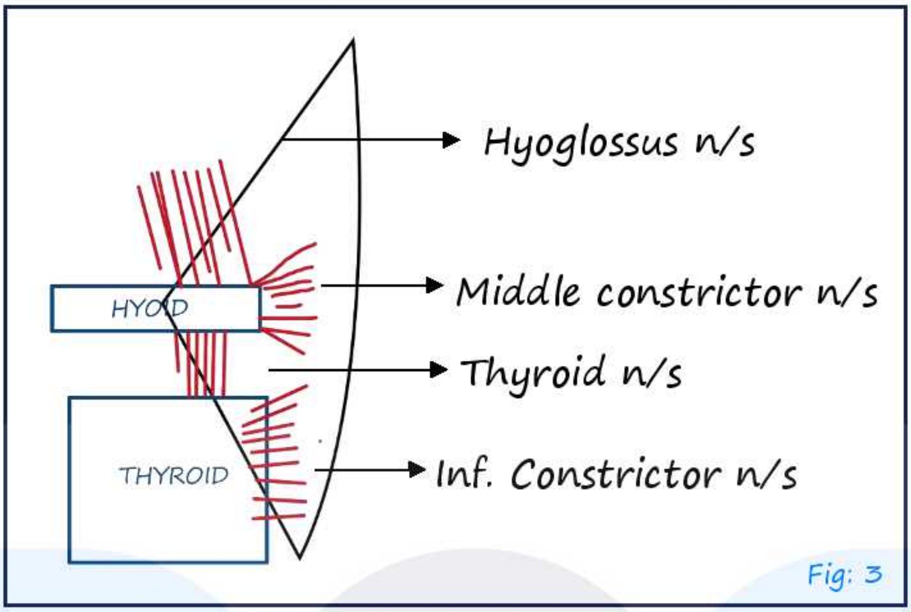

HYOID
THYROID
Hyoglossus n/s
Middle constrictor n/s
Thyroid n/s
Inf. Constrictor n/s

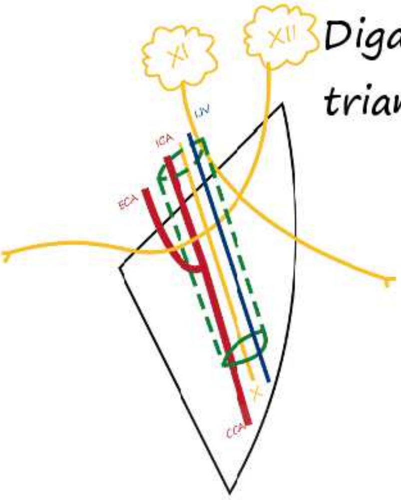
Fig: 3

- Hyoid bone
- Thyroid
- Hyoglossus
- Middle constrictor
- Thyrohyoid
- Inferior constrictor

Roof

- Platysma
- Cervical branch of facial nerve
- Transverse cervical nerve

Contents



Digastric triangle → carotid triangle → Digastric triangle

Fig: 3

- XII CN → Digastric triangle → Carotid triangle → Digastric triangle
- XI CN → Digastric triangle → Carotid triangle → Posterior triangle

Contents

1. Carotid sheath
2. Ansa cervicalis
3. Sympathetic trunk
4. X, XI and XII
5. Internal jugular vein
6. Common carotid artery
7. Internal Carotid artery
8. External Carotid artery
    - Superior thyroid artery
    - Lingual artery
    - Facial artery

  - Ascending pharyngeal
  - Occipital artery
- 5 out of 8 branches of external carotid artery are present in the carotid triangle

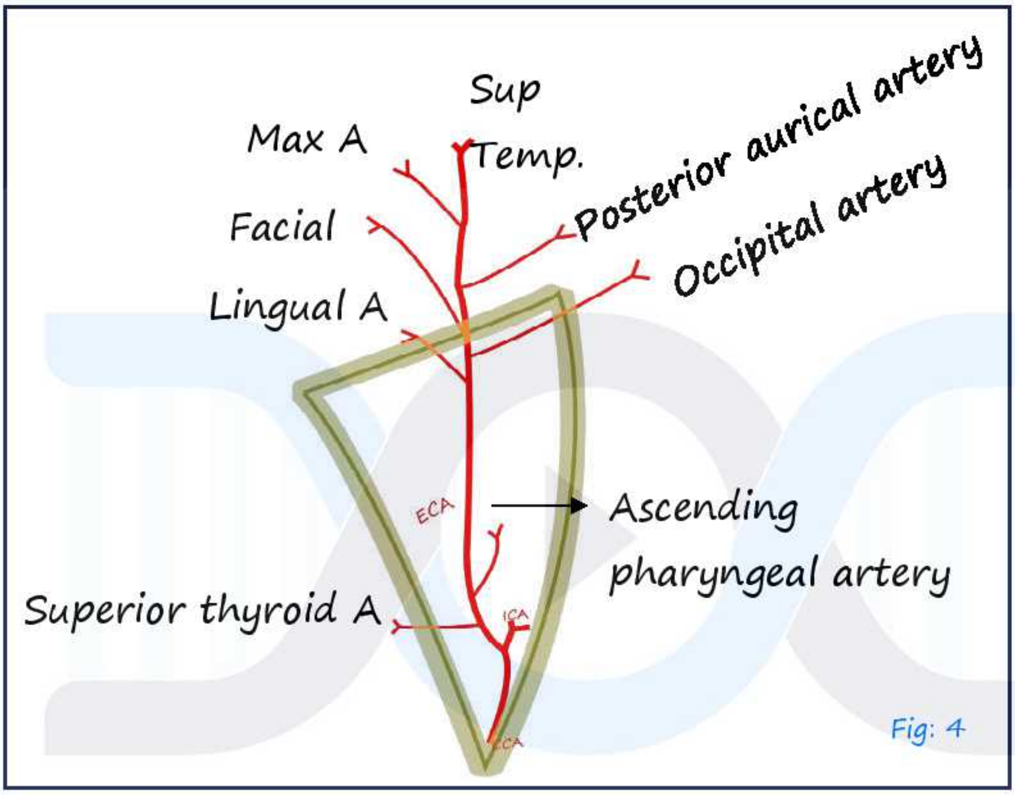

Sup
Temp.
Max A
Facial
Lingual A
Posterior aurical artery
Occipital artery
ECA
Ascending pharyngeal artery
Superior thyroid A
ICA
CCA

Fig: 4

- Occipital artery → Carotid triangle → posterior triangle
- Terminal branches of external carotid artery

↙ ↘

Maxillary artery   Superficial temporal artery

DOC TUTORIALS
LOGIN FOR SUCCESS

DIGASTRIC TRIANGLE OF NECK

Digastric/Submandibular Triangle 00:00:17

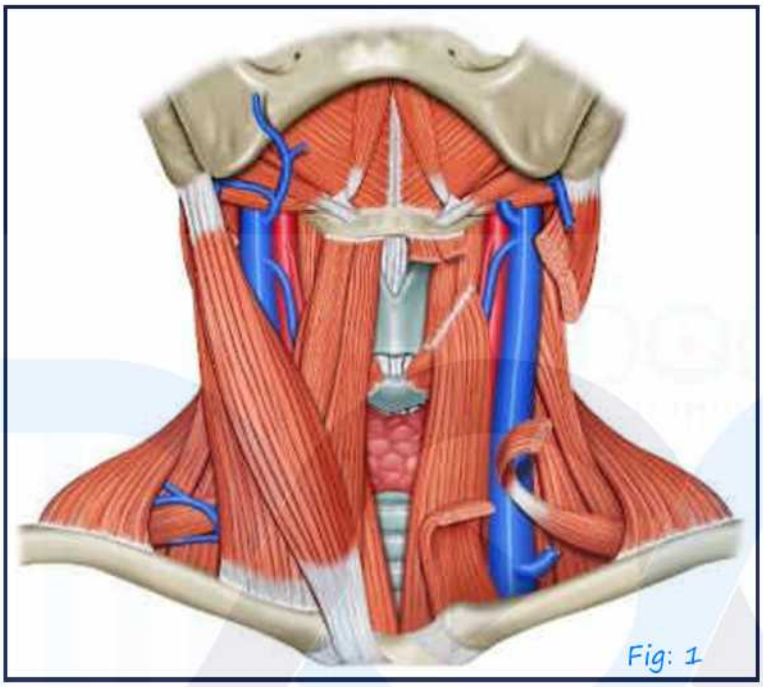
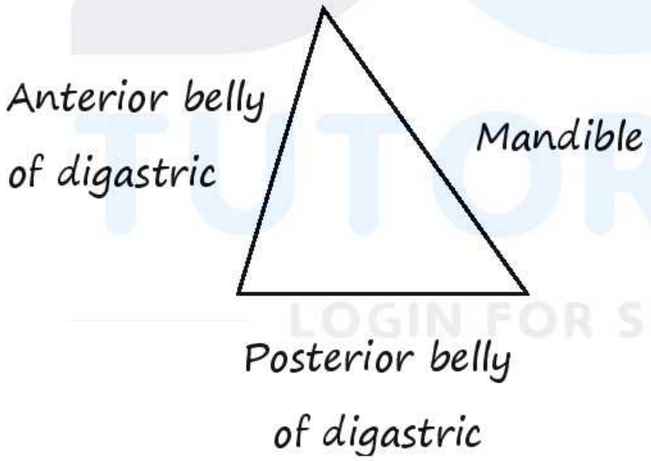


Fig: 1

DOC TUTORIALS LOGIN FOR SUCCESS


Anterior belly of digastric
Mandible
Posterior belly of digastric

Boundaries

- Mandible
- Anterior belly of digastric
- Posterior belly of digastric

Superficial relations of hyoglossus muscle

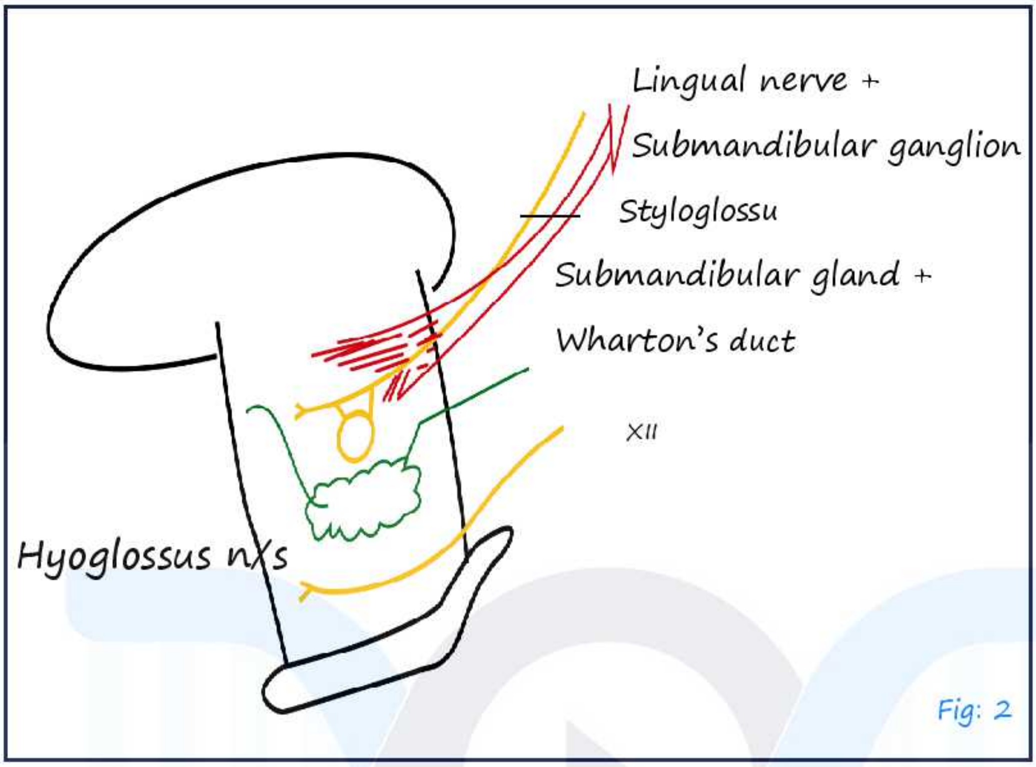

Lingual nerve +
Submandibular ganglion
Styloglossu
Submandibular gland +
Wharton's duct
XII
Hyoglossus m/s

Fig: 2

- Lingual nerve + Submandibular ganglion
- Styloglossus
- Submandibular gland + Wharton's duct
- XII CN

Structures deep to hyoglossus muscle

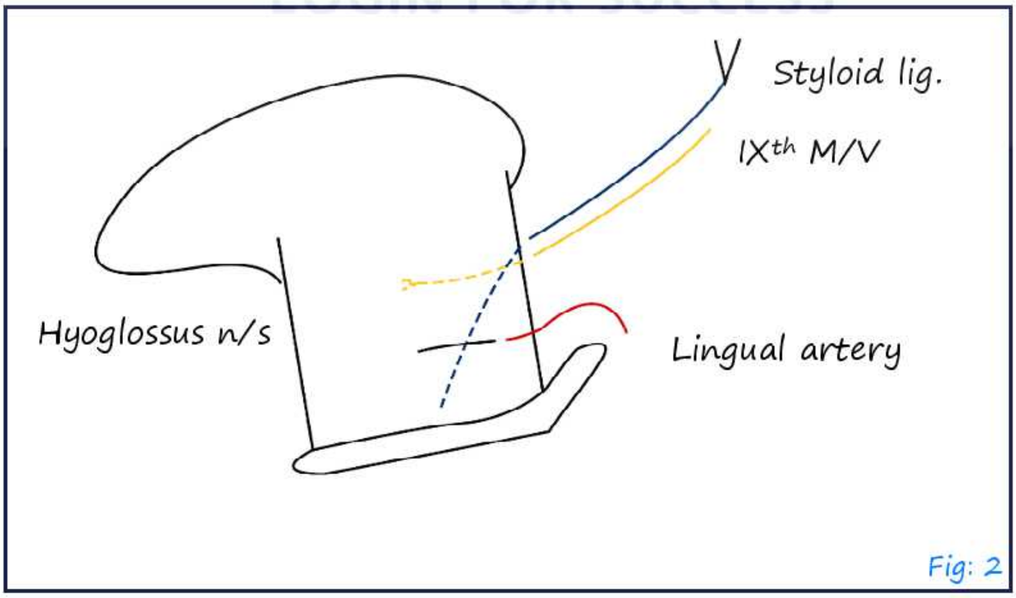

Styloid lig.
IXth M/V
Hyoglossus m/s
Lingual artery

Fig: 2

- Styloid ligament
- IX CN
- Lingual artery

Structures superficial to ⟷ Structures Mylohyoid
present deep to Hyoglossus

Superficial to Mylohyoid

i. Superficial part of submandibular gland
ii. Anterior belly of digastric
iii. Mylohyoid nerve and vessels.

CRANIAL FOSSA AND CRANIAL FORAMEN

Cranial Fossae 00:01:53

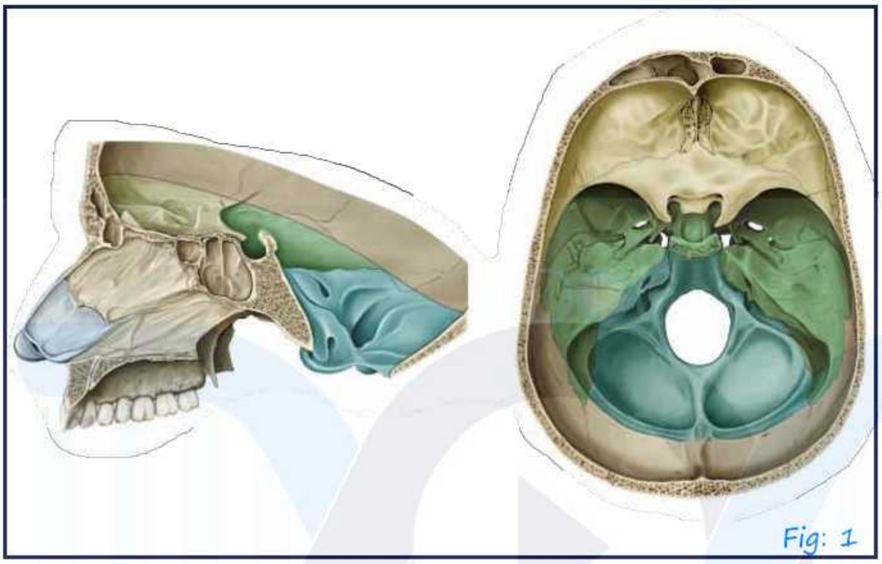


Fig: 1

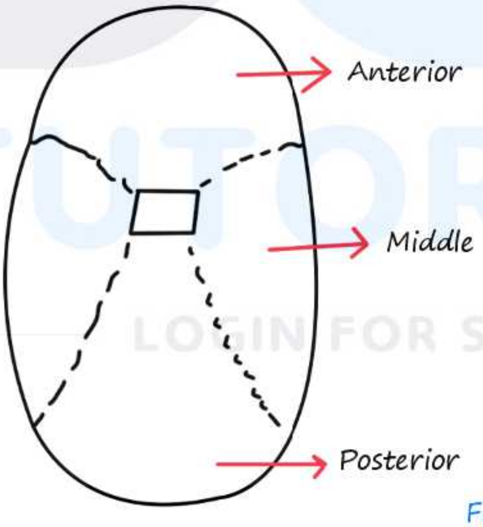

Anterior
Middle
Posterior

Fig: 2

- Openings are called foramens.

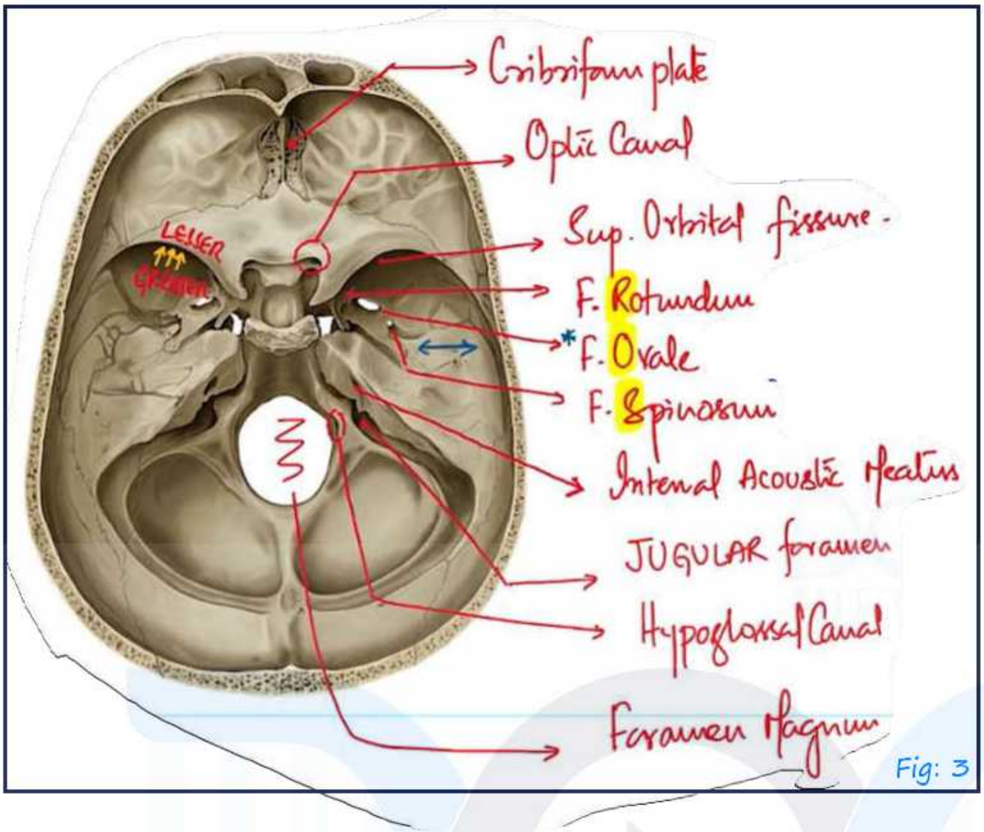

Cribriform plate
Optic Canal
Sup. Orbital fissure
F. Rotundum
F. Ovale
F. Spinosum
Internal Acoustic Meatus
JUGULAR foramen
Hypoglossal Canal
Foramen Magnum
LESSER
GREATER

Fig: 3

Foramens	Structures passing through items
• Cribriform plate	CN I
• Optic canal	CN II, Ophthalmic artery (ICA)
• Superior Orbital Fissure [between the greater & lesser wings]	III, IV, VI, V_1 (branches), Ophthalmic vein
• Foramen Rotundum	V_2
• Foramen Ovale	V_3
• Foramen Spinosum	Nervous spinosus, Middle meningeal artery.
• Internal Acoustic Meatus	VII, VIII, Labyrinthine vessels
• Jugular Foramen	IX, X, XII, inferior petrosal sinus, sigmoid sinus

- Structures passing through Foramen ovale:
  - **M** – Mandibular nerve (V_3)
  - **A** – Accessory meningeal artery
  - **L** – Lesser petrosal nerve
- **E** – Emissary veins.
- The chief nerve [nervous spinosus] and the chief artery [middle meningeal artery] to the dura matter pass through the **FORAMEN SPINOSUM.**
- Middle Meningeal Artery $\xrightarrow{\text{Rupture}}$ Epidural Haemorrhage.
- **Hypoglossal canal** – XII
- **Foramen Magnum** – Medulla
  - Vertebral artery
  - Anterior and posterior spinal arteries
  - Apical ligament of dens
  - Tectorial membrane

Foramen Lacerum 00:24:47

- Internal carotid artery (only in superior part)

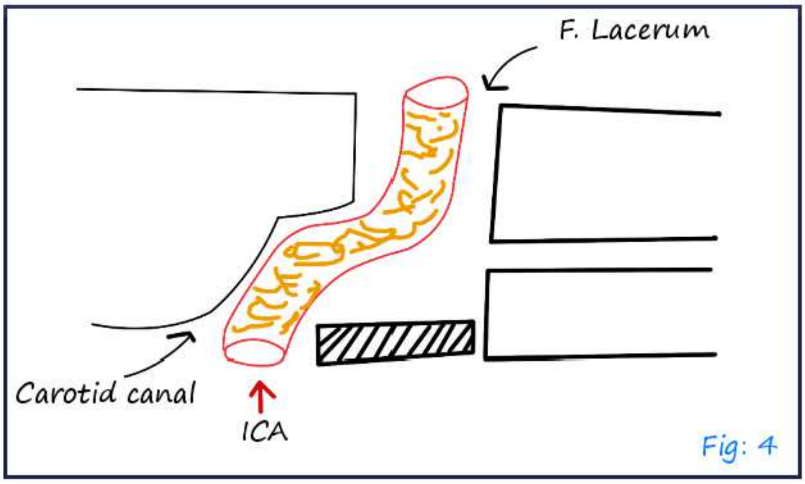


Fig: 4

- Around the internal carotid artery, sympathetic plexus of nerves is present, from where the DEEP PETROSAL NERVE begins.

AUDITORY PATHWAY

Auditory pathway 00:00:55

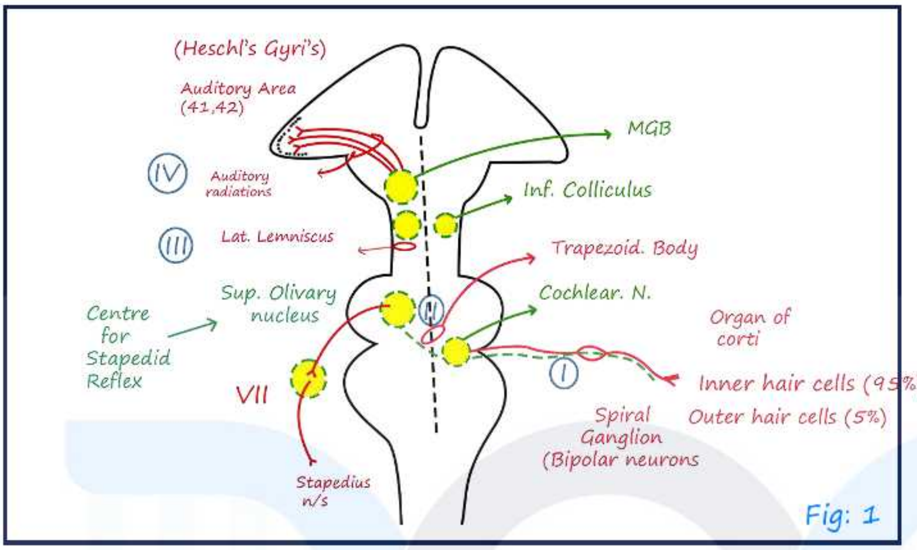

(Heschl's Gyri's)
Auditory Area (41,42)
IV
Auditory radiations
III
Lat. Lemniscus
Sup. Olivary nucleus
Centre for Stapedid Reflex
VII
Stapedius n/s
MGB
Inf. Colliculus
Trapezoid. Body
Cochlear. N.
Organ of corti
II
I
Inner hair cells (95%)
Outer hair cells (5%)
Spiral Ganglion (Bipolar neurons

Fig: 1

- 95% of the fibres begin form inner hair cells, while 5% of the fibres begin from outer hair cells.
- Cochlear nucleus is located at the ponto-medullary junction.
- Ponto-medullary junction → CN VI, VII x VIII exit out (between pons & medulla)
- Superior olivary nucleus is located in the pons.
- Inferior olivary nucleus is in the medulla oblongata.
- Lemniscus is always formed after crossing.

- Any injury to the lemniscus, effect is always seen on the contralateral side.

- First order neurons → Spiral ganglion along with bipolar neurons
- Second order neurons → Trapezoid body
- Third order neurons → Lateral lemniscus
- Fourth order neurons → Auditory radiations
  - Therefore, auditory pathway is a 4-order neuron system

TUTORIALS LOGIN FOR SUCCESS

- Superior olivary nucleus: Centre for stapedial reflex

Arrangement of the structures of auditory pathway from periphery to centre 00:15:28

- Internal ear
- Cochlear nucleus
- Superior olivary nucleus
- Lateral lemniscus
- Inferior colliculus
- Medial geniculate body
- Auditory radiations
- Auditory area

TEMPORO – MANDIBULAR JONTS AND MUSCLES OF MASTICATION

Temporo – mandibular Joint (TMJ) 00:00:31

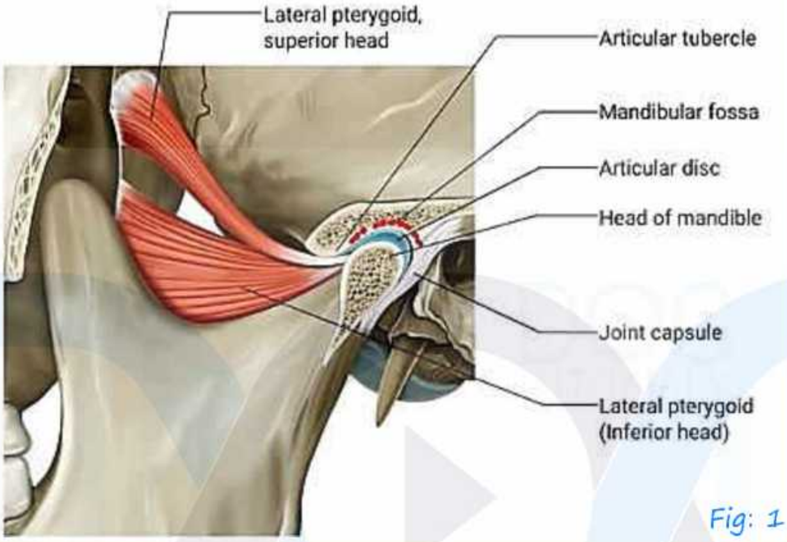

Lateral pterygoid, superior head
Articular tubercle
Mandibular fossa
Articular disc
Head of mandible
Joint capsule
Lateral pterygoid (Inferior head)

Fig: 1

- Type: Synovial Joint
- Subtype: Condylar
- Articulating Bones

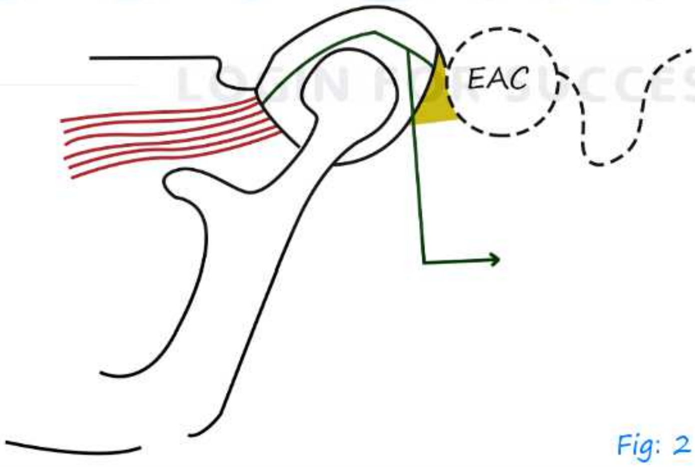


Fig: 2

- **Articular Disc: Continuation of tendon of lateral pterygoid**
  - Fibrocartilaginous

TUTORIALS LOGIN FOR SUCCESS

- Upper compartment → Gliding movement
- Lower compartment → Gliding movement and Rotation
- Central part is avascular

Ligaments of TMJ 00:09:34

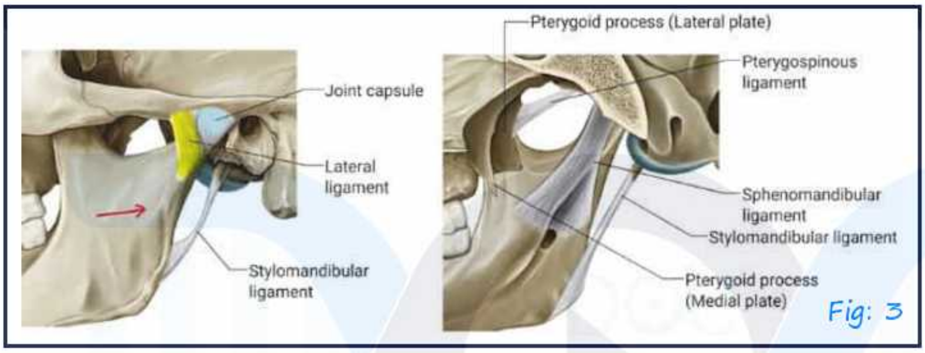

Joint capsule
Lateral ligament
Stylomandibular ligament
Pterygoid process (Lateral plate)
Pterygospinous ligament
Sphenomandibular ligament
Stylomandibular ligament
Pterygoid process (Medial plate)

Fig: 3

- Ligaments of TMJ
  I. True Ligaments
    - Joint capsule
    - Lateral/ Temporo- Mandibular ligament
  II. Accessory Ligaments/ False Ligaments:
    - Stylomandibualr Ligaments
    - Sphenomandibular Ligaments

Arterial Supply 00:14:59

- Maxillary Artery
- Superficial Temporal Artery

Nerve Supply 00:15:48

- Auriculotemporal Nerve (ATN)
- Masseteric Nerve

i. Temporalis

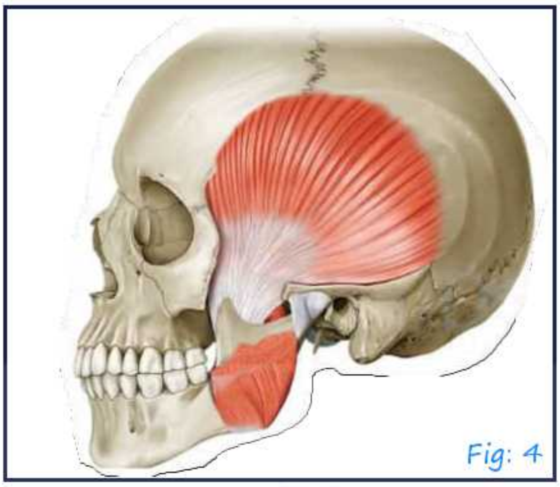


Fig: 4

ii.Masseter

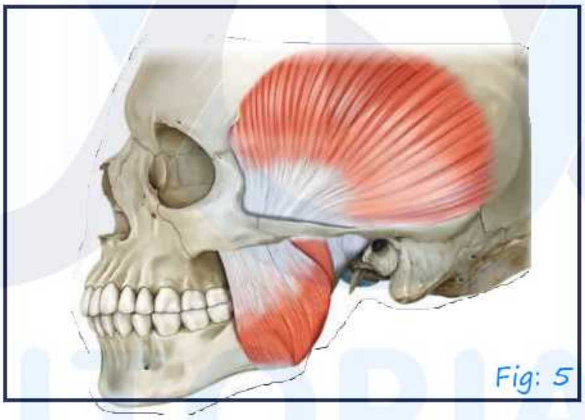


Fig: 5

iii. Lateral Pterygoid

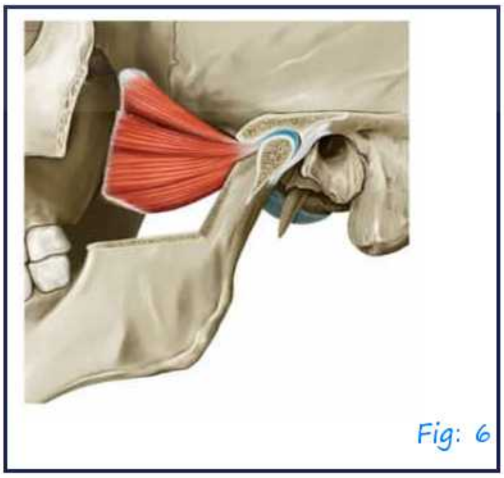


Fig: 6

iv. Medical Pterygoid

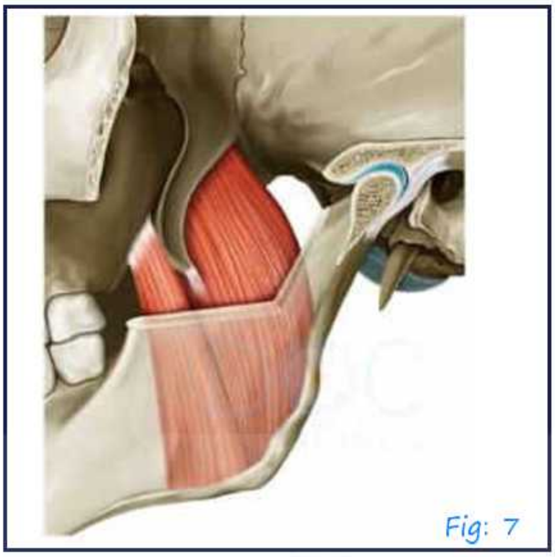


Fig: 7

- Lateral Pterygoid → Depression of Mandible
- Temporalis → Retraction of Mandible
- Side wise movement of mandible → Alternate action of lateral and Medial pterygoid muscles
- Accessory muscle mastication → Buccinator
- Muscle most commonly involved in trismus → Medial pterygoid

AfroTafreeh.com
TUTORIALS
LOGIN FOR SUCCESS

BLOOD VESSELS OF HEAD AND NECK

External Carotid Artery 00:01:13

- Branch of common carotid artery.
- It gives 8 branches

    i. Superior thyroid activity → first branch
    ii. Lingual artery
    iii. Facial artery
    } Ventral branches

    iv. Ascending pharyngeal artery – only medial branch

    v. Occipital artery
    vi. Posterior auricular artery
    } Dorsal branches.

    vii. Maxillary artery → largest branch
    viii. Superficial Temporal artery
    } Terminal branches

- Ascending pharyngeal artery – only medial branch
- First branch – superior thyroid artery
- largest branch – Maxillary artery (gives out 16 branches)

DOCTUTORIALS LOGIN FOR SUCCESS

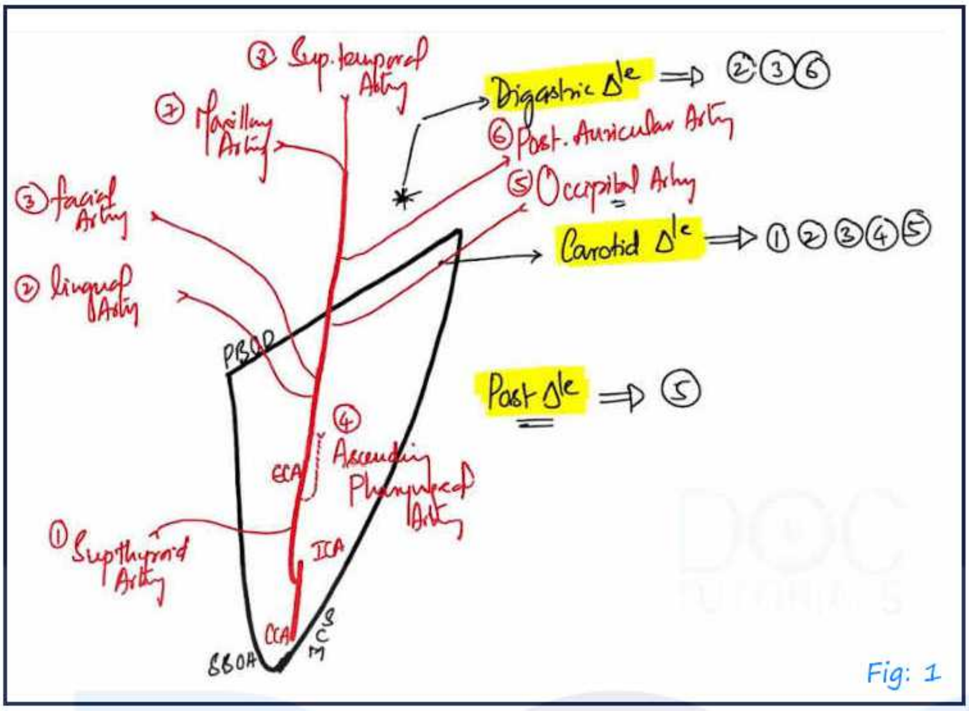

① Sup. temporal Artery
⑦ Maxillary Artery
③ facial Artery
② lingual Artery
PBOD
④ Ascending Pharyngeal Artery
ECA
ICA
CCA
① Sup thyroid Artery
SBOA
SCM
Digastric Δle ⇒ ② ③ ⑥
⑥ Post. Auricular Artery
⑤ Occipital Artery
Carotid Δle ⇒ ① ② ③ ④ ⑤
Post Δle ⇒ ⑤

Fig: 1

Carotid triangle

1. Superior thyroid
2. lingual
3. Facial
4. Ascending pharyngeal
5. Occipital

Digastric triangle

2. Lingual
3. Facial
6. Posterior Auricular

- Posterior Triangle: - 5. occipital

2nd part: - 5 branches to muscles of mastication

- Artery to masseter
- Artery to lateral pterygoid
- Artery to medial pterygoid
- 2 deep temporal arteries

3rd part – 6 branches (PIG PAS)

1. Posterior superior alveolar artery
2. Infra orbital artery
3. Greater palatine artery
4. Pharyngeal artery
5. Artery to pterygoid canal
6. Sphenopalatine artery/artery of epistaxis.
    - Greater palatine artery and sphenopalatine artery contribute to little's area.
    - Largest branch → sphenopalatine artery/artery of epistaxis.

Maxillary Artery 00:16:56

- Largest branch of external carotid artery.
- It is divided into 3 parts by lateral pterygoid muscle.

Branches: – 1st part: 5 branches (MAAID)

i. Middle meningeal artery → **Foramen spinosum**

ii. Accessory meningeal artery → **Foramen ovale (male)**

iii. Anterior tympanic artery

iv. Inferior alveolar artery →

v. Deep auricular artery

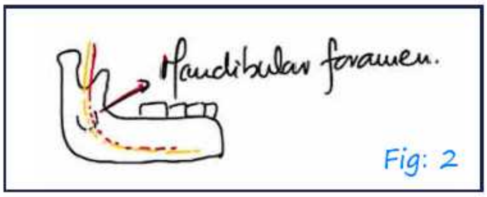
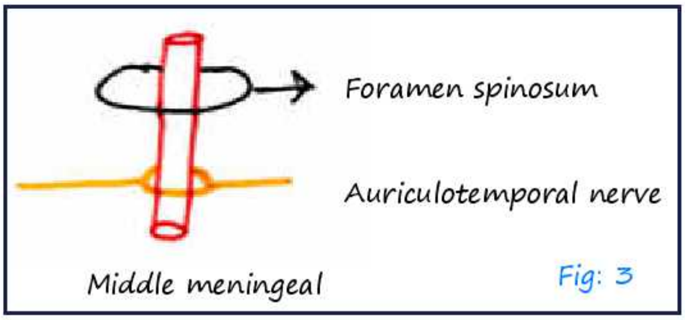


Fig: 2

DX TUTORIALS LOGIN FOR SUCCESS


Foramen spinosum
Auriculotemporal nerve
Middle meningeal
Fig: 3

- Middle meningeal artery is enclosed by auriculotemporal nerve.
- Rupture of middle meningeal artery → EPIDURAL/EXTRADURAL hemorrhage

- Inferior alveolar nerve and inferior alveolar vessels pass through a foramen on the medial side of the mandible → MANDIBULAR FORAMEN

Facial Artery 00:34:27

- Branch of external carotid artery
- Course and branches.

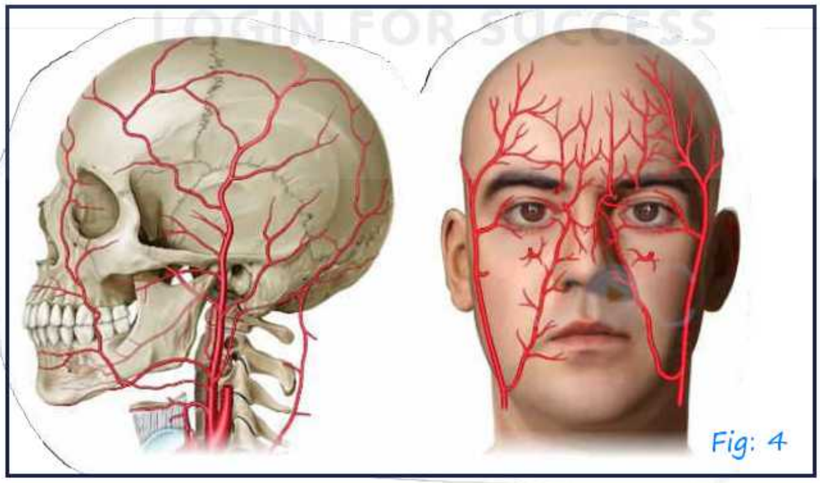


Fig: 4

Branches in face – 4

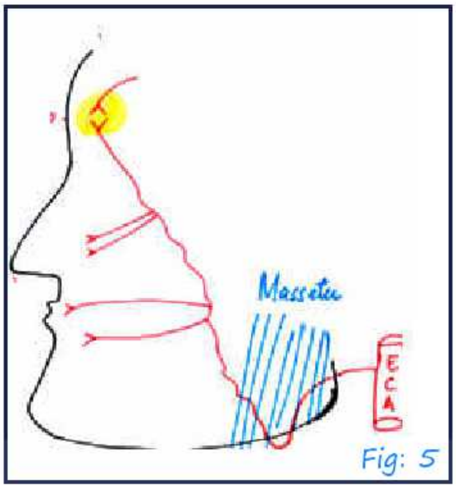


Fig: 5

- Angular branch
- Lateral nasal branches
- Superior labial artery
- Inferior labial artery

Branches in Neck – (TAGS)

- T – Tonsillar artery
- A – Ascending palatine artery
- G – Glandular artery
- S – Submental artery

Note-

i. Facial artery – Tortuous artery (not facial vein)

ii. Facial artery turns at antero-inferior border of masseter.

iii. Angular branch and dorsal nasal branch form anastomosis

↓

ECA and ICA form an anastomosis near the Medial angle.

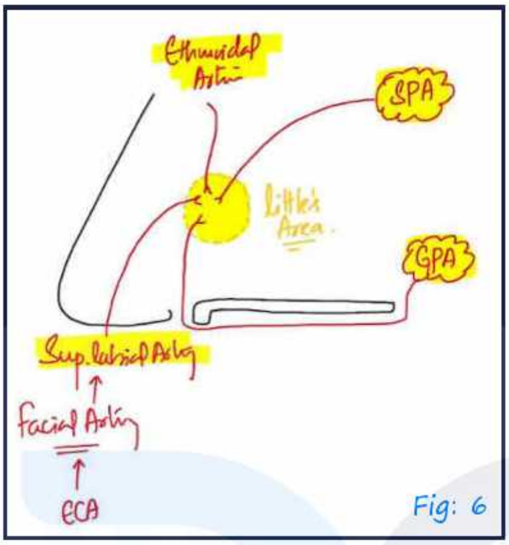

Ethmoidal Artery
SPA
Little's Area.
GPA
Sup. labial Artery
Facial Artery
ECA

Fig: 6

- All the arteries contributing to little's area are the branches of external carotid artery except ethmoidal artery which is a branch of internal carotid artery.

AnuTutorials.com
TUTORIALS
LOGIN FOR SUCCESS

SUBCLAVIAN ARTERY, SCALENUS ANTERIOR MUSCLE, VEINS OF FACE

Subclavian Artery 00:00:10

- Divided into 3 parts by Scalenus anterior muscle.
- Branches

1st 2nd 3rd (VIT C & D)
VIT C D

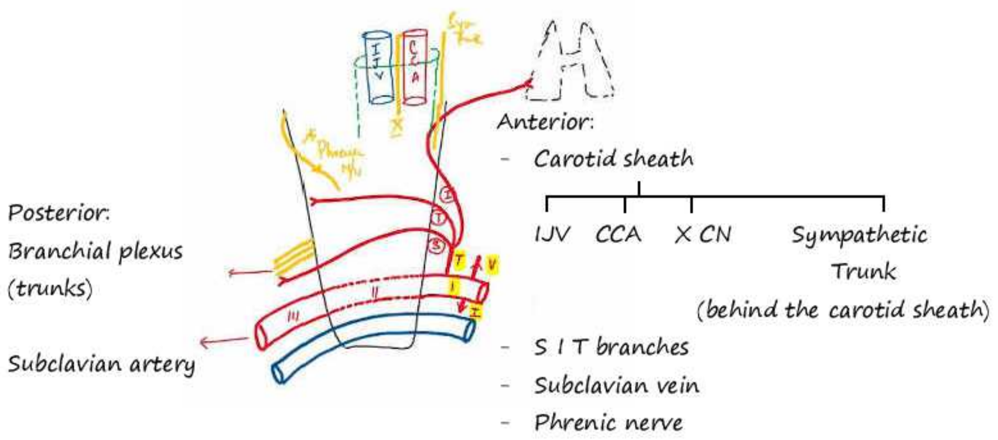
- 1st part – 3 branches:

V – 1. Vertebral artery
I – 2. Internal Thoracic artery
T – 3. Thyrocervical trunk
S – Suprascapular Artery
I – Inferior Thyroid Artery
T – Transverse Cervical Artery
Superficial Deep

TUTORIALS LOGIN FOR SUCCESS

- 2nd part → Costocervical trunk
- 3rd part → **Dorsal Scapular Artery**
  - Deep branch is also named as DORSAL SCAPULAR ARTERY of transverse cervical artery.

Relations of Scalenus anterior muscle: -


I J V
C C A
X
Sym Trunk
Phrenic N.
①
Ⓣ
Ⓢ
T
V
I
I
II
III
Posterior:
Branchial plexus
(trunks)
Subclavian artery
Anterior:
- Carotid sheath
IJV
CCA
X CN
Sympathetic Trunk
(behind the carotid sheath)
- S I T branches
- Subclavian vein
- Phrenic nerve

Scalenus anterior muscle

Anterior

i. Carotid sheath
   - IJV
   - CCA
   - X CN
   - Sympathetic trunk

ii. S, I, T branches

iii. Subclavian vein

iv. Phrenic nerve

Posterior

i. Branchial plexus (Trunk)

ii. Subclavian artery

Veins of Face 00:16:54

DOC TUTORIALS LOGIN FOR SUCCESS

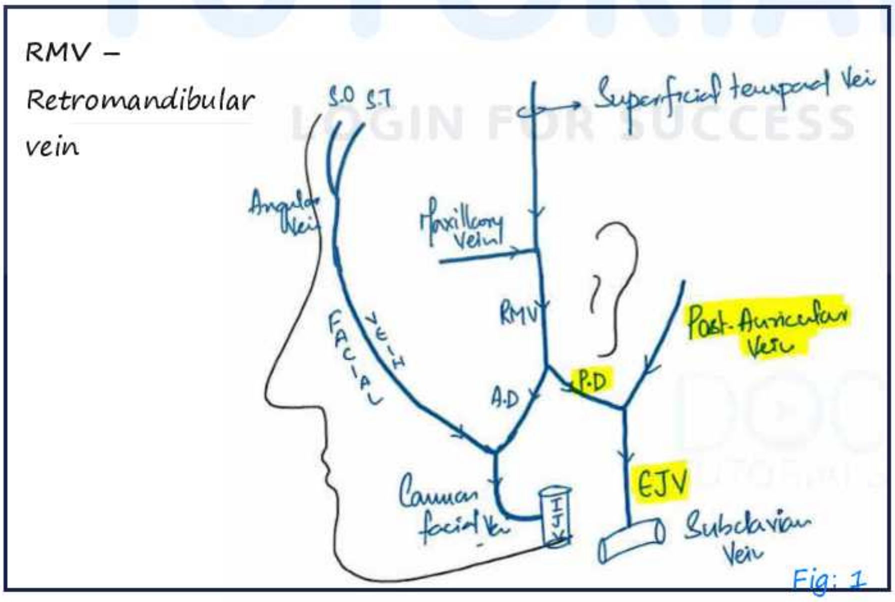

RMV – Retromandibular vein
S.O
S.T
Superficial temporal Vein
Angular Vein
Maxillary Vein
RMV
FACIAL VEIN
A.D
P.D
Post-Auricular Vein
Common facial Vein
IJV
EJV
Subclavian Vein

Fig: 1

- External Jugular vein is formed by ← posterior auricular vein + posterior division of retromandibular vein
- Facial vein + Anterior division of retromandibular vein → common facial vein → drains into the internal jugular vein.

Dangerous area of the Face 00:22:04

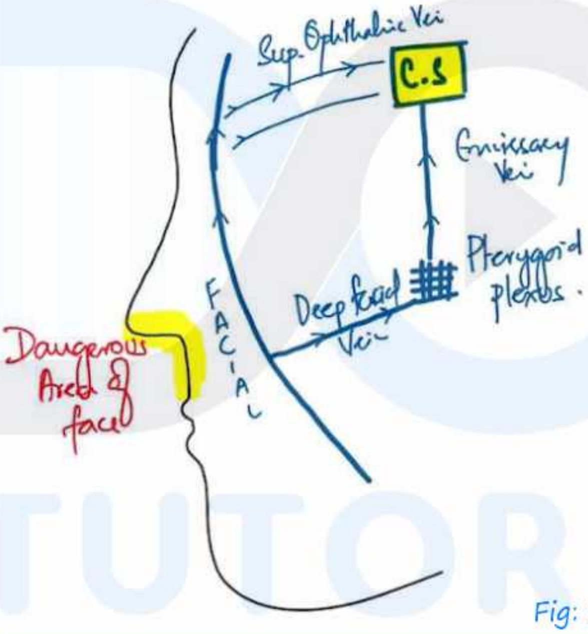

Sup. Ophthalmic Vei
C.S
Emissary Vei
Pterygoid plexus.
Deep facial Vei
FACIAL
Dangerous Area of face

Fig: 2

- Infections in the dangerous area of the face travels and reach the cavernous sinus
  (Extracranial infection → reaches the inside of cranium)

TRANSVERSE SECTION OF THE NECK

Transverse Section of the Neck 00:00:19

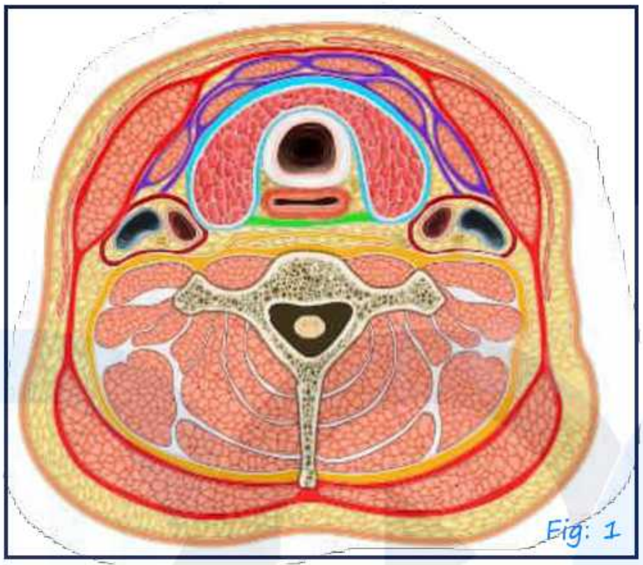


Fig: 1

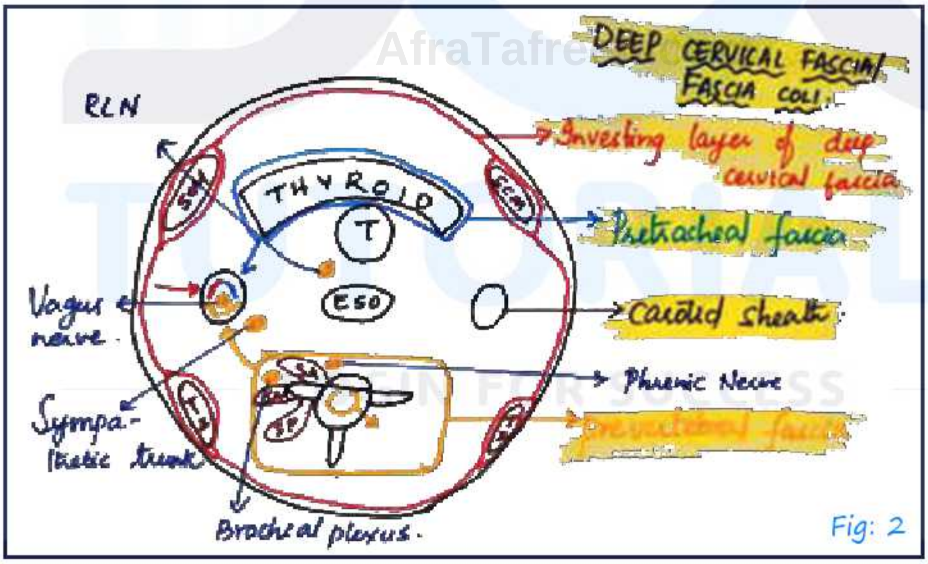

DEEP CERVICAL FASCIA/ FASCIA COLI
RLN
Investing layer of deep cervical fascia
THYROID
SCM
T
Pretracheal fascia
Vagus nerve
ESO
Carotid sheath
SA
SP
Phrenic Nerve
Prevertebral fascia
Sympathetic trunk
Brachial plexus.

Fig: 2

Pretracheal fascia

- Content: Thyroid gland
- Forms a false capsule around thyroid gland.

Prevertebral fascia

- Extends to form axillary sheath
- Content: Brachial plexus (cords)
- Axillary vessels.

Carotid sheath

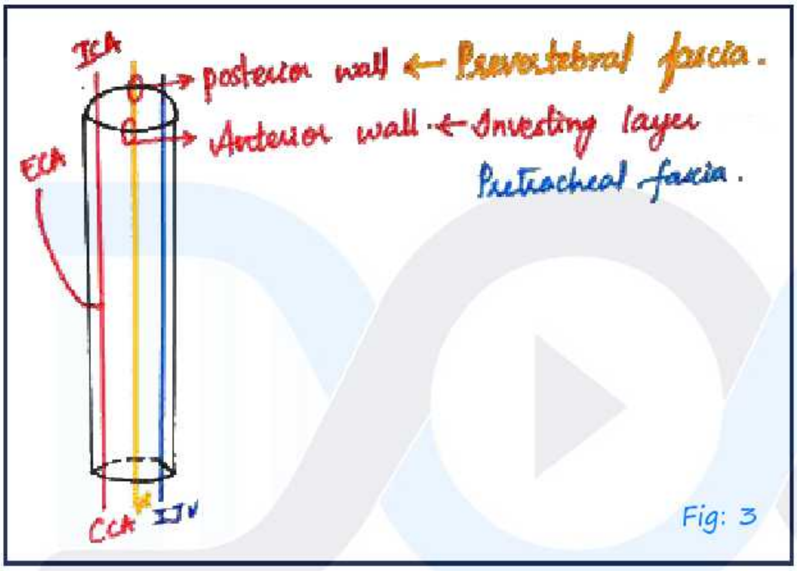

ICA
posterior wall ← Prevertebral fascia.
Anterior wall ← Investing layer
Pretracheal fascia.
ECA
CCA
IJV

Fig: 3

Carotid sheath

Posterior wall
- Prevertebral fascia

Anterior wall
- Investing layer and pretracheal fascia

Contents

1. Common carotid artery
2. Internal carotid artery
3. Internal jugular vein
4. Vagus nerve
5. IX – Glossopharyngeal nerve
6. XI – Accessory nerve

Relations of Carotid sheath: 00:18:00

Anterior

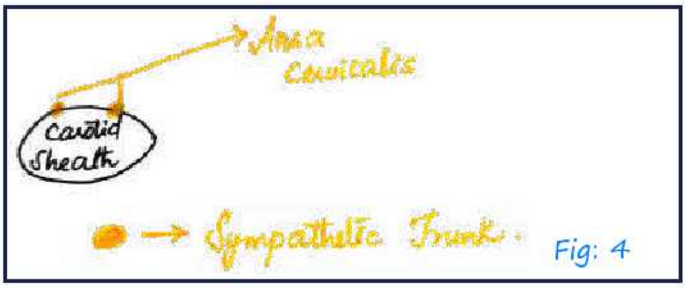

Ansa cervicalis
Carotid Sheath
Sympathetic Trunk.

Fig: 4

Posterior

- Anteriorly
  - Ansa cervicalis is embedded in the anterior wall
- Posteriorly
  - Sympathetic trunk.

Investing layers

- 2 muscles
  - Sternocleidomastoid
  - Trapezius
- 2 glands
  - Parotid gland
  - Submandibular gland
- 2 spaces
  - Suprasternal space/BURN's space
  - Supraclavicular space
- 2 ligaments
  - Stylomandibular ligament
  - Sphenomandibular ligament

- 2 Pulleys
  - Digastric
  - Omohyoid

Sagittal section of the neck 00:29:20

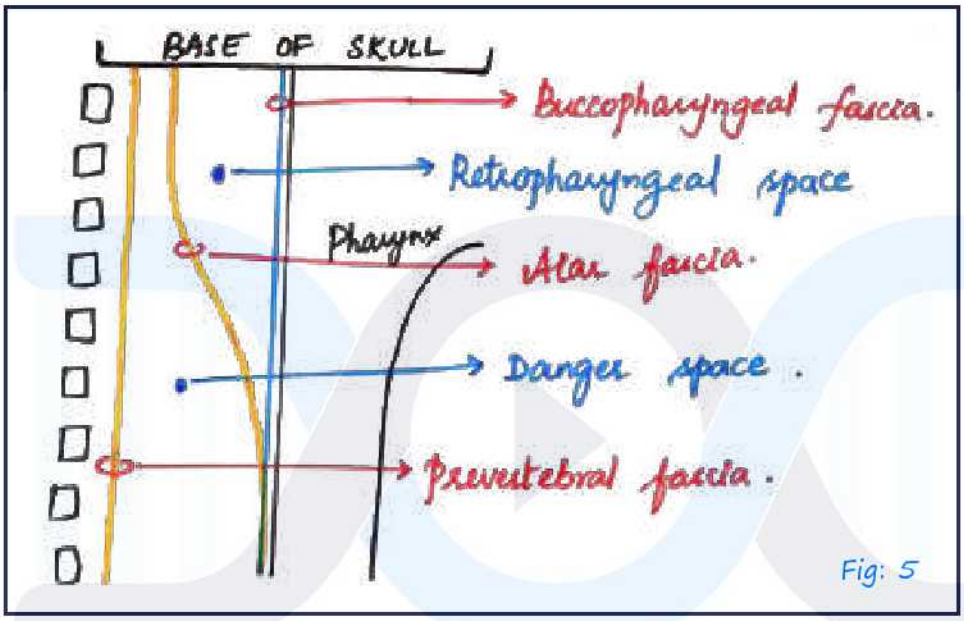

BASE OF SKULL
Buccopharyngeal fascia.
Retropharyngeal space
Pharynx
Alar fascia.
Danger space.
Prevertebral fascia.

Fig: 5

- Infection in the danger space moves downwards into trachea and oesophagus causing dysphagia & dyspnea.

DOC TUTORIALS
LOGIN FOR SUCCESS

LARYNX

Cartilages of Larynx 00:00:33

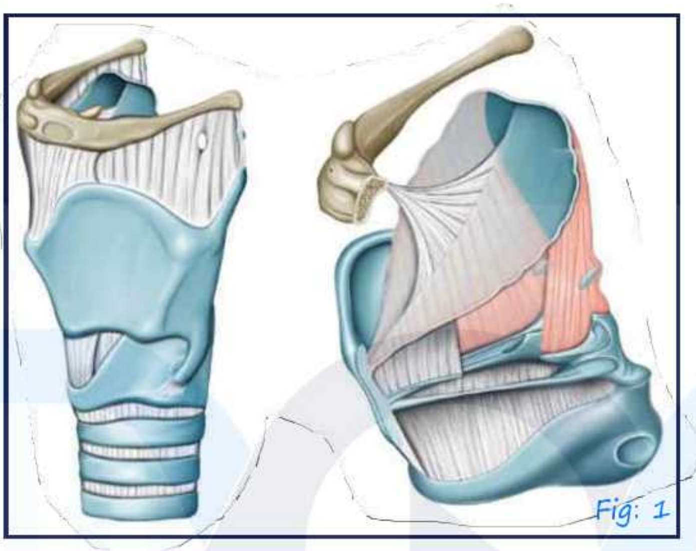


Fig: 1

Cartilages of Larynx

Three Unpaired Cartilages

- Thyroid – HC
- Cricoid – HC
- Epiglottis – EC

Three Paired Cartilages

- Arytenoid
  - Apex – EC
  - Base – HC
- Corniculate – EC
- Cuneiform – EC

(HC → Hyaline Cartilage)

(EC → Elastic Cartilage)

- Epiglottis is Fibroelastic > Elastic
- Hyaline cartilage, after certain age undergoes ossification

AiraTaireen.com
TUTORIALS
LOGIN FOR SUCCESS

Interior of the Larynx 00:10:29

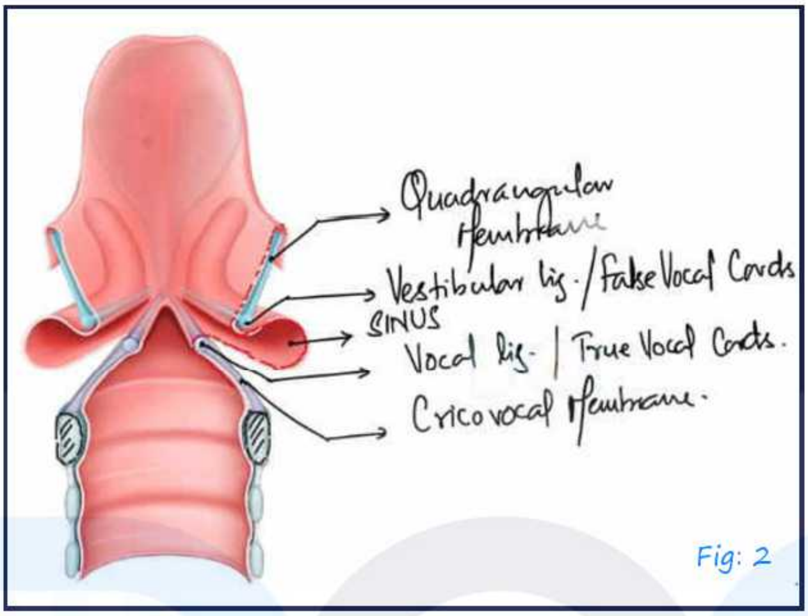

Quadrangular Membrane
Vestibular lig. / False Vocal Cords
SINUS
Vocal lig. | True Vocal Cords.
Cricovocal Membrane.

Fig: 2

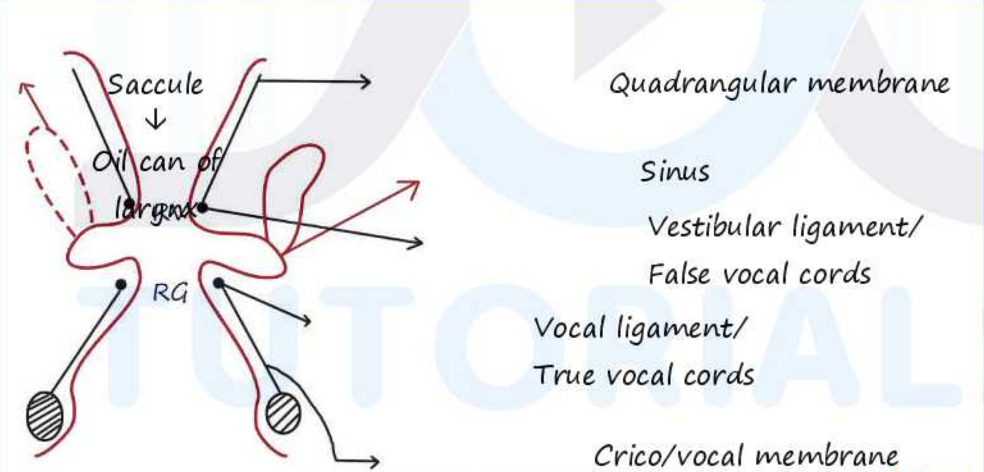

Saccule
↓
Oil can of larynx
RG
Quadrangular membrane
Sinus
Vestibular ligament/
False vocal cords
Vocal ligament/
True vocal cords
Crico/vocal membrane

Fig: 3

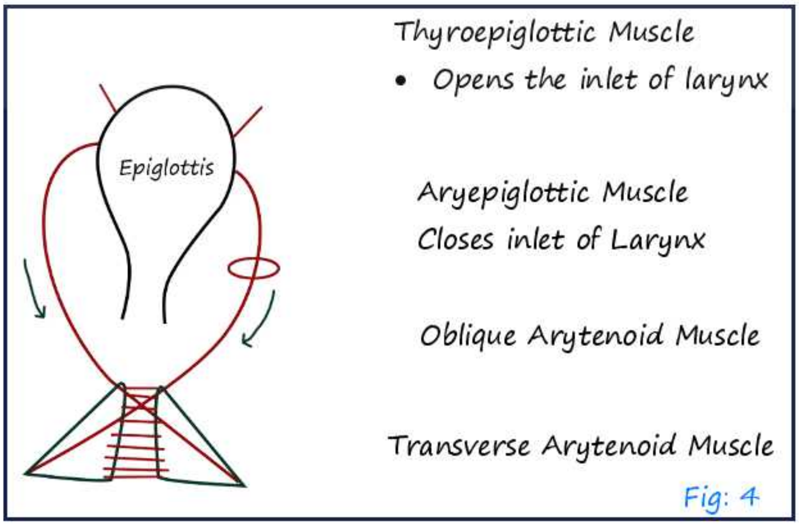

Epiglottis
Thyroepiglottic Muscle
• Opens the inlet of larynx
Aryepiglottic Muscle
Closes inlet of Larynx
Oblique Arytenoid Muscle
Transverse Arytenoid Muscle

Fig: 4

DOC TUTORIALS LOGIN FOR SUCCESS

- Thyroepiglottic muscle → opens the inlet of larynx
- Aryepiglottic muscle → Closer the inlet of larynx

Rima Glottidis

i. Intermembranous space

ii. Intracartilaginous space

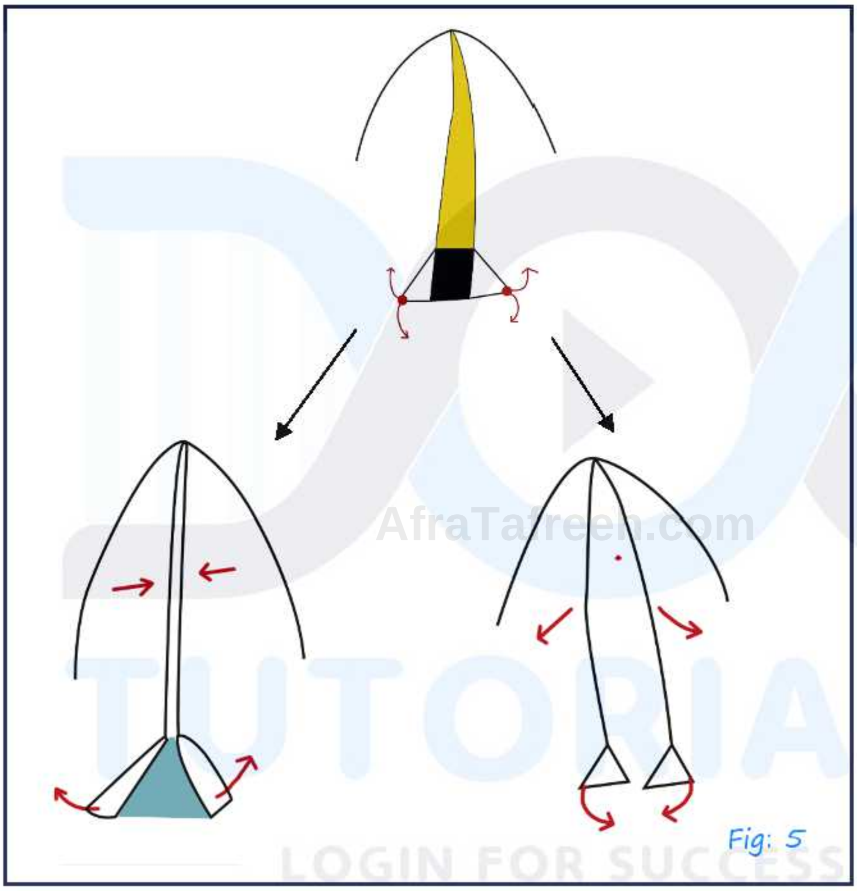


Fig: 5

AfraTafreen.com
TUTORIALS
LOGIN FOR SUCCESS

Lateral cricoarytenoid muscle

- Adduction of Vocal cords

Posterior Cricoarytenoid muscle

- Abduction of Vocal cords
- Safety muscle of Larynx

- RV → Rima Vestibuli → Space between False vocal cords
- RG → Rima Glottidis → Space between True vocal cords

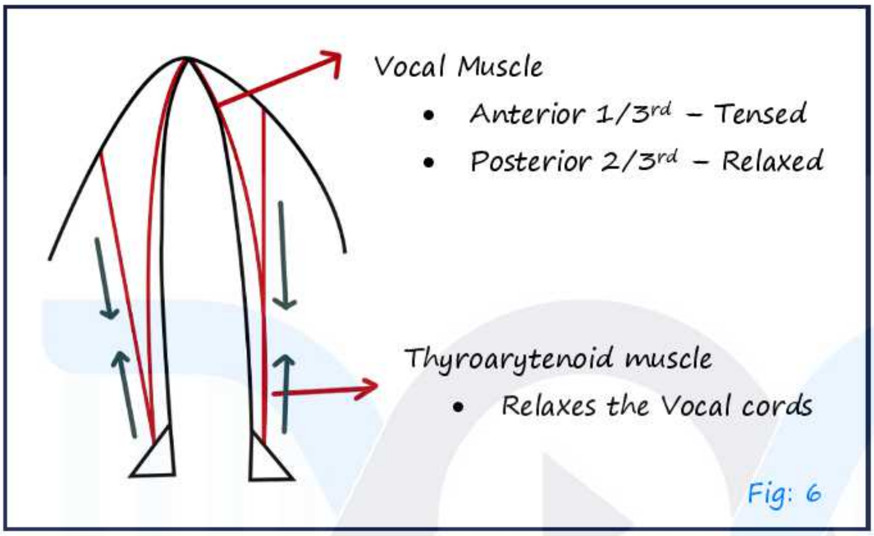

Vocal Muscle
Anterior 1/3rd – Tensed
Posterior 2/3rd – Relaxed
Thyroarytenoid muscle
Relaxes the Vocal cords

Fig: 6

- Vocalis muscle is fused with the vocal cord in the anterior 1/3rd

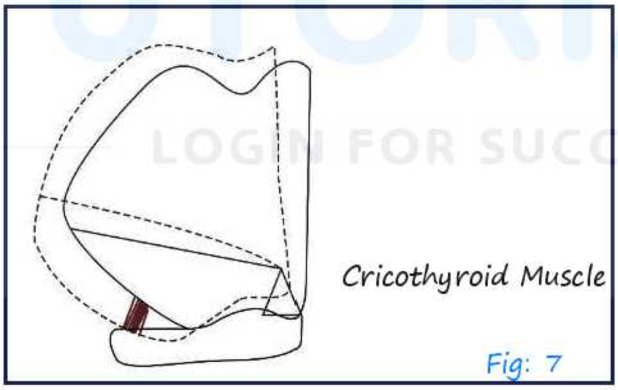

Cricothyroid Muscle

Fig: 7

- Thyroarytenoid muscle → Relaxes the vocal cords
- Cricothyroid muscle → Increases the tension in the vocal cords
  - Only muscle of the larynx which lies outside

Nerve Supply 00:33:00

- All the muscles of the larynx → Recurrent Laryngeal nerve
- Except Cricothyroid → Supplied by External laryngeal nerve
- Internal laryngeal nerve (sensory) – supplies to the mucous membrane inside the larynx above the vocal cords.

PHARYNX

Muscles of pharynx 00:01:03

Muscles of pharynx

Longitudinal muscles: (inner)

i. Stylopharyngeus – IX

ii. Palatopharyngeus – VAC

iii. Salpingopharyngeus – VAC

Circular muscles: (outer)

i. Superior constructor – VAC

ii. Middle constrictor VAC

iii. Inferior constrictor:

- Thyropharyngeus – VAC
- Cricopharyngers – RLN

- VAC – Vago Accessory complex
- RLN – Recurrent laryngeal Nerve

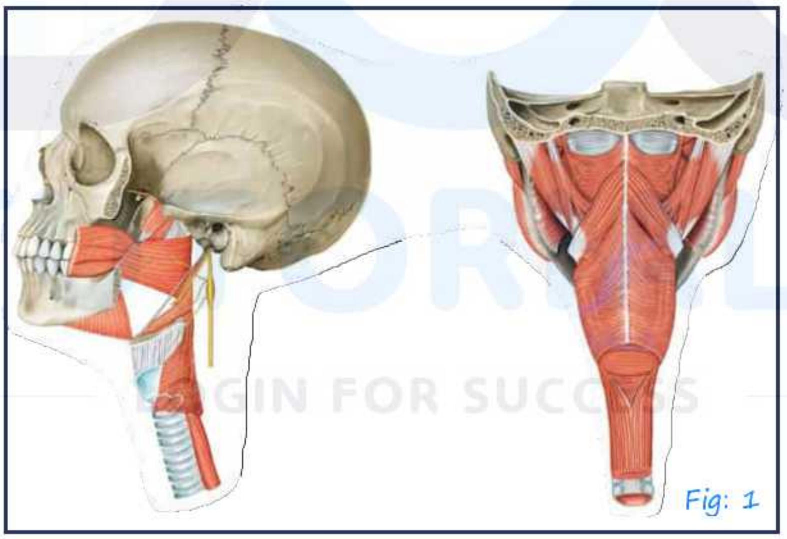


Fig: 1

Wall of pharynx 00:07:47

- Wall of pharynx: – 4 layers:

1. Mucous membrane
2. Pharyngobasilar fascia
3. Muscular layer
4. Buccopharyngeal fascia

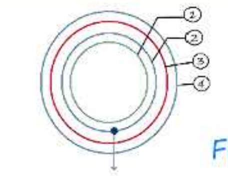


Fig: 2

Pharyngeal Raphae (common insertion for all constrictors)

Killian's dehiscence 00:13:33

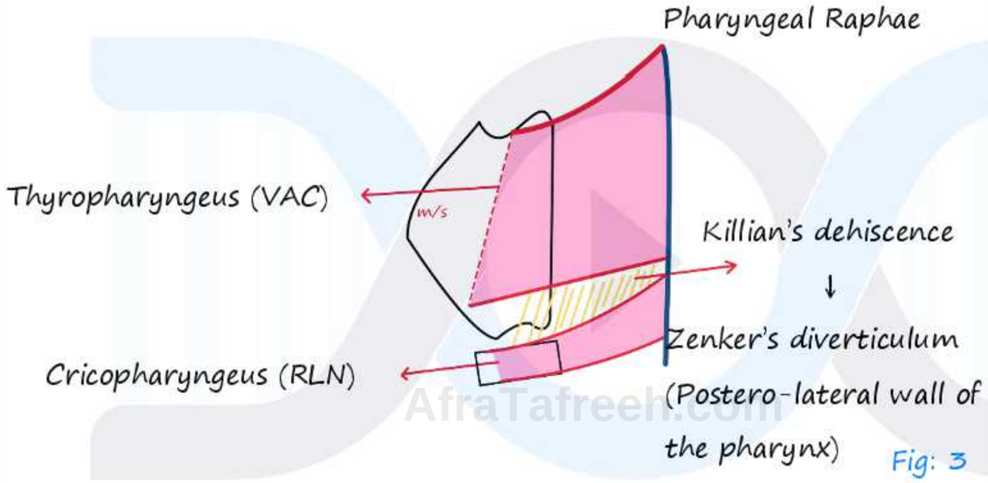

Pharyngeal Raphae
Thyropharyngeus (VAC)
m/s
Killian's dehiscence
↓
Zenker's diverticulum
(Postero-lateral wall of the pharynx)
Cricopharyngeus (RLN)

Fig: 3

- Weak area between thyropharyngeus and cricopharyngeus → Killan's dehiscence.

DOI TUTORIALS LOGIN FOR SUCCESS

Structures passing between constrictors 00:22:27

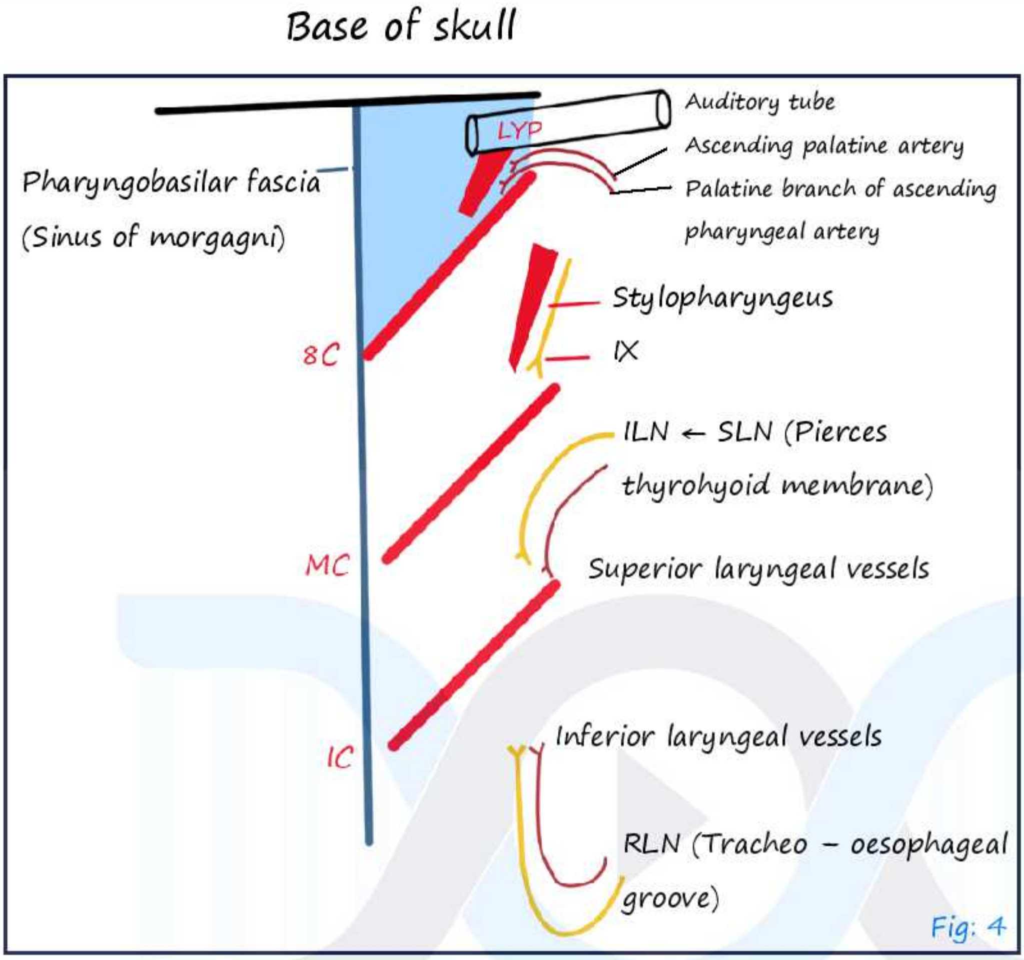

Base of skull
LYP
Auditory tube
Ascending palatine artery
Palatine branch of ascending pharyngeal artery
Pharyngobasilar fascia
(Sinus of morgagni)
SC
Stylopharyngeus
IX
ILN ← SLN (Pierces thyrohyoid membrane)
MC
Superior laryngeal vessels
IC
Inferior laryngeal vessels
RLN (Tracheo – oesophageal groove)

Fig: 4

INTRODUCTION

Nervous system 00:00:36

Central nervous system

- Brain
- Spinal cord

Peripheral nervous system

- Cranial nerves (12 pairs)
- Spinal nerves (31 pairs)
- Cervical SN – 8 pairs
- Thoracic SN – 12 pairs
- Lumbar SN – 5 pairs
- Sacral SN – 5 pairs
- Coccygeal SN – 1 pair

Brain/Encephalon 00:04:00

DOT TUTORIALS LOGIN FOR SUCCESS

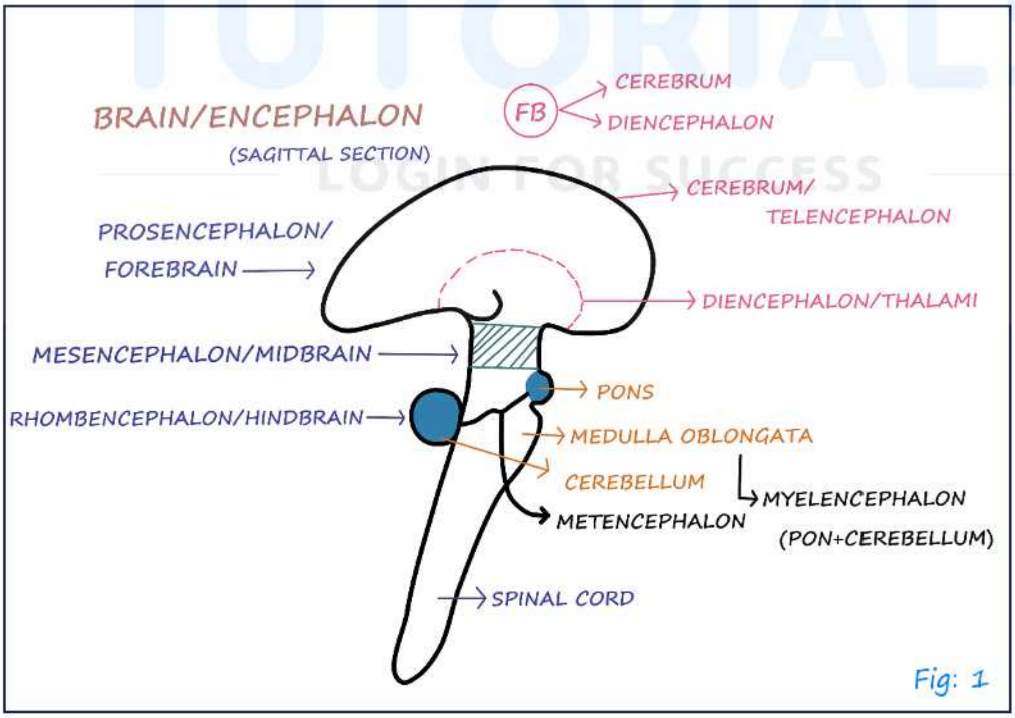

BRAIN/ENCEPHALON
(SAGITTAL SECTION)
FB
CEREBRUM
DIENCEPHALON
CEREBRUM/ TELENCEPHALON
PROSENCEPHALON/ FOREBRAIN
DIENCEPHALON/THALAMI
MESENCEPHALON/MIDBRAIN
PONS
RHOMBENCEPHALON/HINDBRAIN
MEDULLA OBLONGATA
CEREBELLUM
MYELENCEPHALON
METENCEPHALON
(PON+CEREBELLUM)
SPINAL CORD

Fig: 1

Brain/Encephalon

- Prosencephalon/Forebrain
  - Cerebrum/Telencephalon
    +
  - Diencephalon/Thalami
- Mesencephalon/Midbrain
- Rhombencephalon
  - Pons
  - Cerebellum
  - Medulla/Myelencephalon

Coronal section:

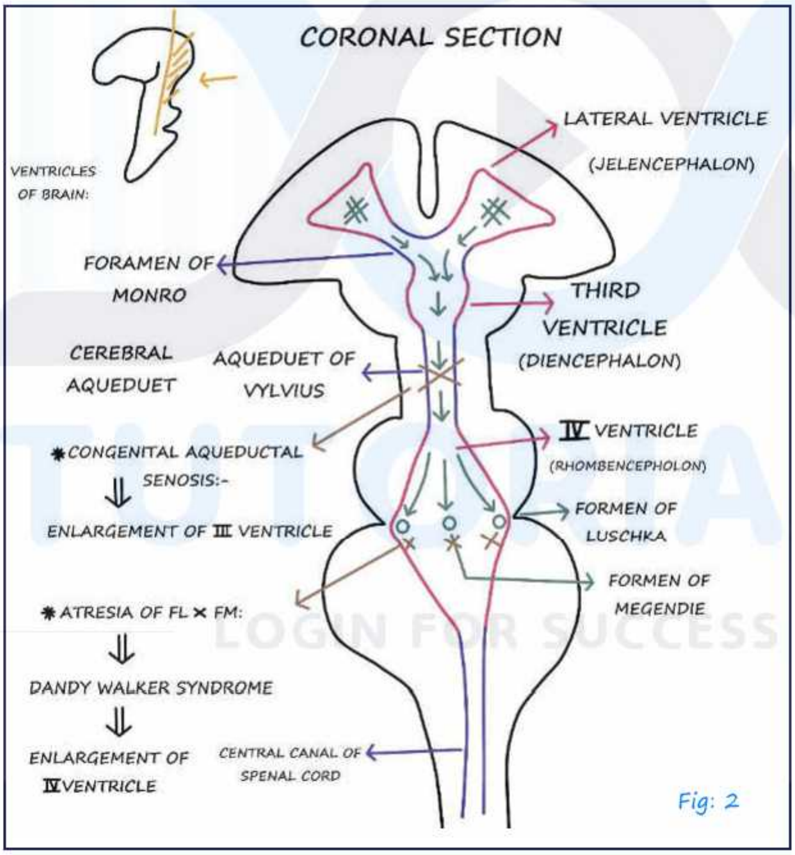

CORONAL SECTION
VENTRICLES OF BRAIN:
LATERAL VENTRICLE (JELENCEPHALON)
FORAMEN OF MONRO
THIRD VENTRICLE (DIENCEPHALON)
CEREBRAL AQUEDUET
AQUEDUET OF VYLVIUS
✱CONGENITAL AQUEDUCTAL SENOSIS:-
⇓
ENLARGEMENT OF III VENTRICLE
IV VENTRICLE (RHOMBENCEPHOLON)
FORMEN OF LUSCHKA
FORMEN OF MEGENDIE
✱ATRESIA OF FL × FM:
⇓
DANDY WALKER SYNDROME
⇓
ENLARGEMENT OF IV VENTRICLE
CENTRAL CANAL OF SPENAL CORD

Fig: 2

- Cerebrospinal fluid (CSF) is formed by the choroid plexus

↓

Choroid plexus (Lateral ventricles)

↓

Foramen of monro

↓

Third ventricle

↓

Aqueduct of salvias

↓

Fourth ventricle

↓

2 foramens on lateral side → Foramen of Luschka

1 foramen in the middle → Foramen of magendie

↓

Subarachnoid space

- Two lateral ventricles ventricle → Telencephalon→Foramen of manro
- III ventricle → Diencephalon
- IV ventricle → Rhombencephalon

Aqueduct of sylvius/cerebral aqueduct

AiraTaiteen.com TUTORIALS LOGIN FOR SUCCESS

Clinical aspect 00:18:13

- Congenital aqueductal stenosis → Most common cause of congenital hydrocephalus
- Enlargement of III ventricle
- Atresia of foramen of Luschka and foramen of megendie
- Dandy – walker's syndrome
- Enlargement of IV ventricle

SPINAL CORD

External features of spinal cord 00:00:36

- Extent: C1 → L1 (Lower border) → Adults
  C1 → L3 (upper border) → Neonates
- Length: 45cms in males
  42cms in females
- Shape: Cylindrical
- Enlargement: It is enlarged at two places
  1. Branchial plexus (Cervical enlargement)
  2. Lumbosacral plexus (Lumbar enlargement)

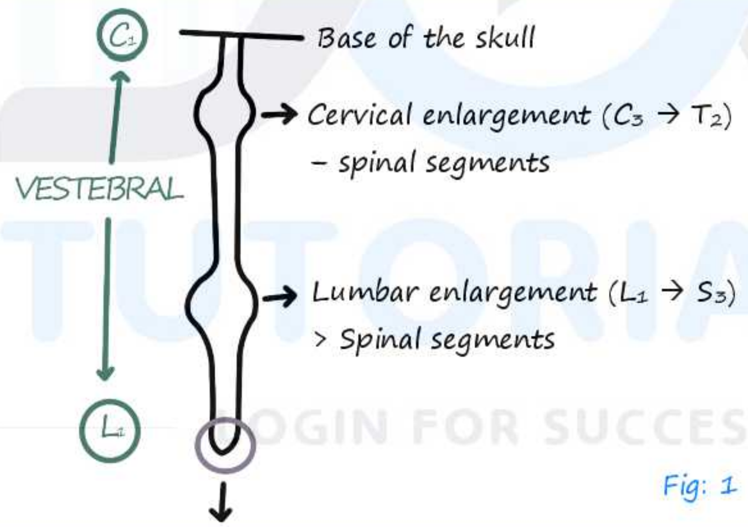

C₁
VESTEBRAL
L₁
Base of the skull
Cervical enlargement (C₃ → T₂)
– spinal segments
Lumbar enlargement (L₁ → S₃)
> Spinal segments

Fig: 1

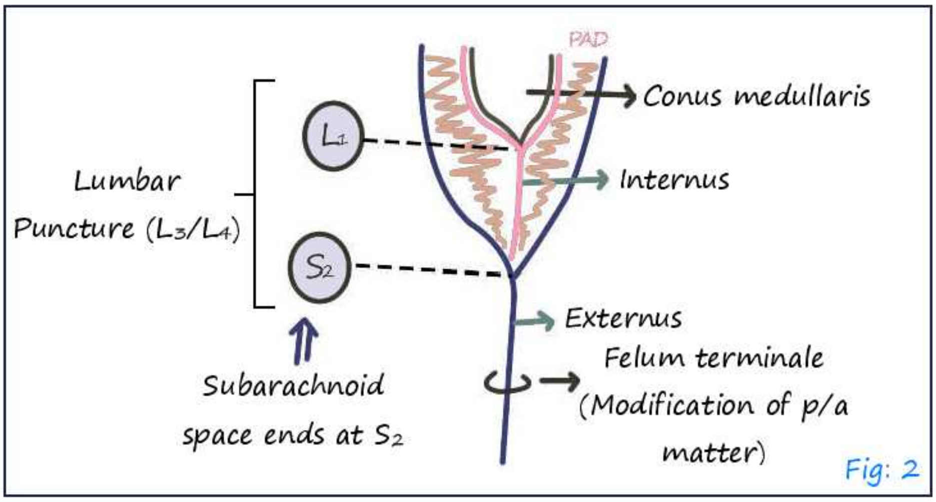

PAD
Conus medullaris
L₁
Internus
Lumbar
Puncture (L₃/L₄)
S₂
Externus
Felum terminale
(Modification of p/a
matter)
Subarachnoid
space ends at S₂

Fig: 2

Felum terminale (Modification of p/a matter)

Internus – P/a matter

Externus – Fibrous band of P+A+D

- Arachnoid and dura matter merge with the pia matter at the level of S_2
- Subarachnoid space: → Between arachnoid and dura matter
  - Contains CSF
  - Ends at the level of S_2
  - Best site for lumbar puncture → L3 – L4
- Spinal cords ends at the level of L1 (lower border)
- Filum terminal
  - Internus → Pia matter
  - Externals → Fibrous band of pia + Arachnoid + Dura matter

Cauda equina 00:12:30

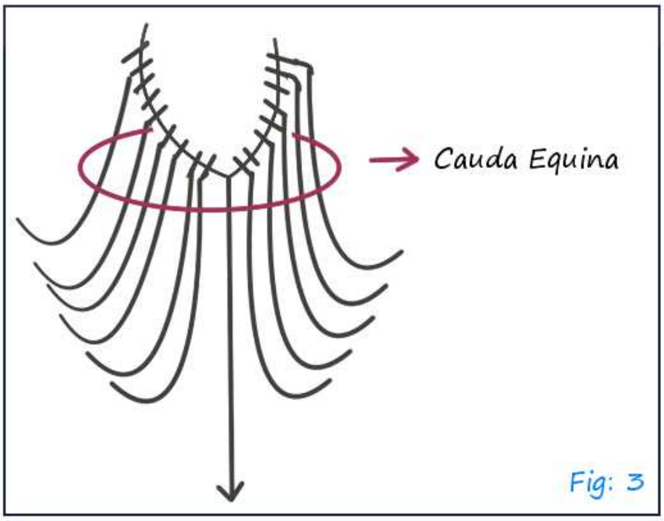


Fig: 3

Modifications of spinal pia matter 00:14:42

1. Filum terminale
- Externus (D+A+P)
- Internus (P)

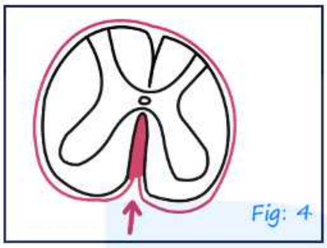


Fig: 4

Linea splendens (pia matter fills the Anterior median fissure

2. Linea splendens
- Pia matter filling the anterior median fissure

3. Ligamentum denticulatum
- 21 pairs (21 on each side)

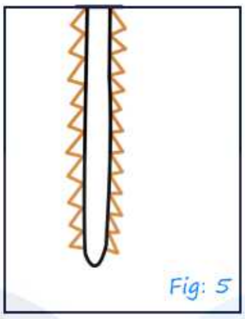


Fig: 5

(Tooth like projections on either side seen on the lateral side)

Internal features of spinal cord 00:19:30

- Transverse section of spinal cord

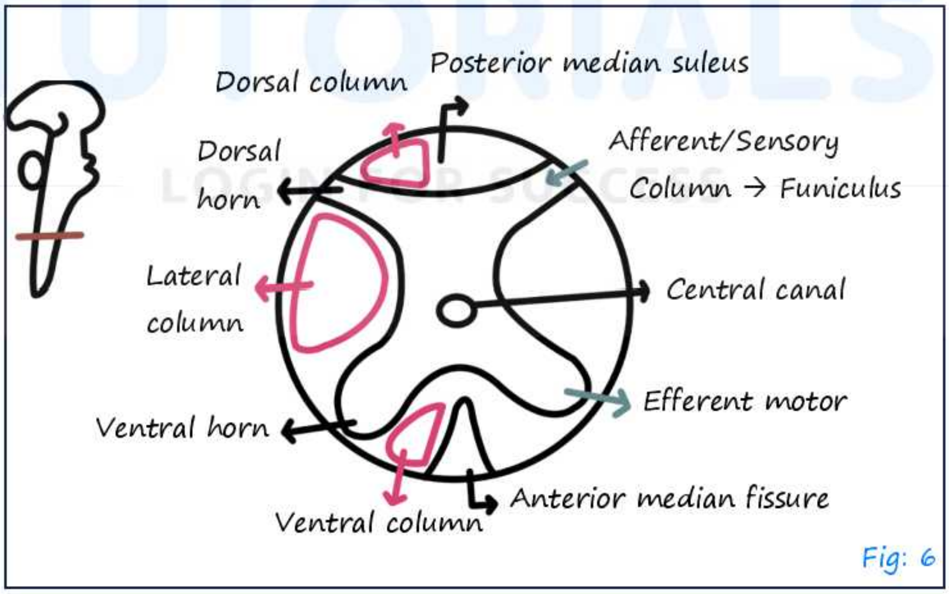

Dorsal column
Posterior median suleus
Dorsal horn
Afferent/Sensory Column → Funiculus
Lateral column
Central canal
Efferent motor
Ventral horn
Anterior median fissure
Ventral column

Fig: 6

- Grey matter of spinal cord is present inside in the shape of "H" or "Butterfly shape"

- Extension of grey matter → 2 horns → Dorsal horn & Ventral horn
- White matter is in the periphery
- It is divided into 3 columns by the 2 horns of grey matter

  1.Dorsal column

  2.Ventral column

  3.Lateral column
- Dorsal horn is purely Afferent (information arrives) → Sensory
- Ventral horn is purely Efferent/Motor (Information exits)

WHITE MATTER – ASSOCIATION AND COMMISURAL FIBRES

white matter 00:01:04

- Definition: Bundle of Axons in CNS

1. Association fibres
   - Connect different areas in same hemisphere
2. Commissural fibres/ Commissures
   - Connect same areas in different lobes/hemisphere
3. Projection fibres
   - Connect different functional areas in brain and spinal cord

Association fibres 00:05:26

Short association fibres:

- Connect the adjacent gyri

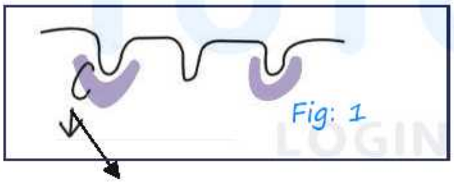


Fig: 1

Arcuate fasciculus

Long association fibres:

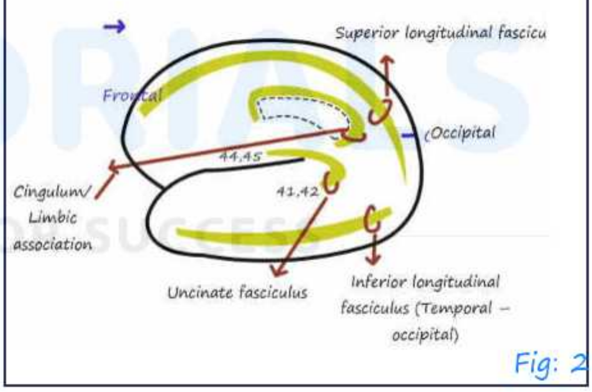

Superior longitudinal fascicu
Frontal
Occipital
44,45
41,42
Cingulum/
Limbic
association
Uncinate fasciculus
Inferior longitudinal
fasciculus (Temporal –
occipital)

Fig: 2

- Frontal $\xleftrightarrow[\text{Fasciculus}]{\text{Superior longitudinal}}$ occipital
- Temporal $\xleftrightarrow[\text{Fasciculus}]{\text{Inferior longitudinal}}$ occipital
- 44, 45(Broca's area) $\xleftrightarrow{\text{Uncinate fasciculus}}$ 41, 42 (auditory speech)
- Around the corpus callosum → Cingulum

- Cingulum connects different parts of limbic system present around the corpus callosum therefore cingulum is also known as limbic association fibres
- Broca's speech area (44, 45) $\xleftrightarrow{\text{Arcuate fasciculus}}$ Wernicke's speech area (22, 39, 40)
- Broca's speech area (44, 45) $\xleftrightarrow{\text{Uncinate fasciculus}}$ Auditory area (41, 42)

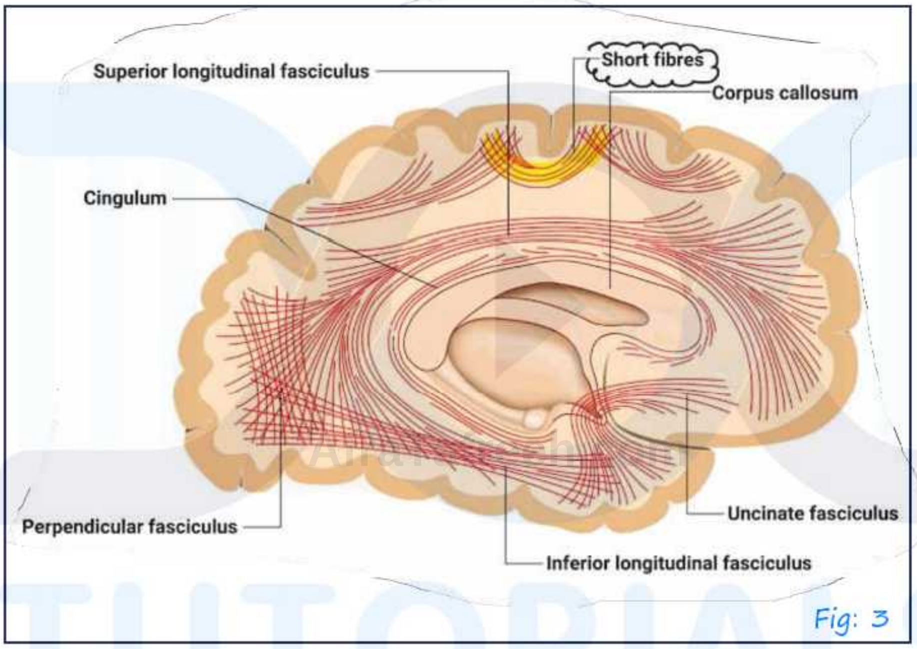

Superior longitudinal fasciculus
Short fibres
Corpus callosum
Cingulum
Perpendicular fasciculus
Uncinate fasciculus
Inferior longitudinal fasciculus

Fig: 3

DBMCI TUTORIALS LOGIN FOR SUCCESS

Commissural fibres/Commissures 00:15:00

- Corpus callosum
  - Largest fibres
  - Parts – Rostrum
    Genu
    Body
    Splenium
- Connects the frontal, parietal, temporal and occipital lobes on both sides

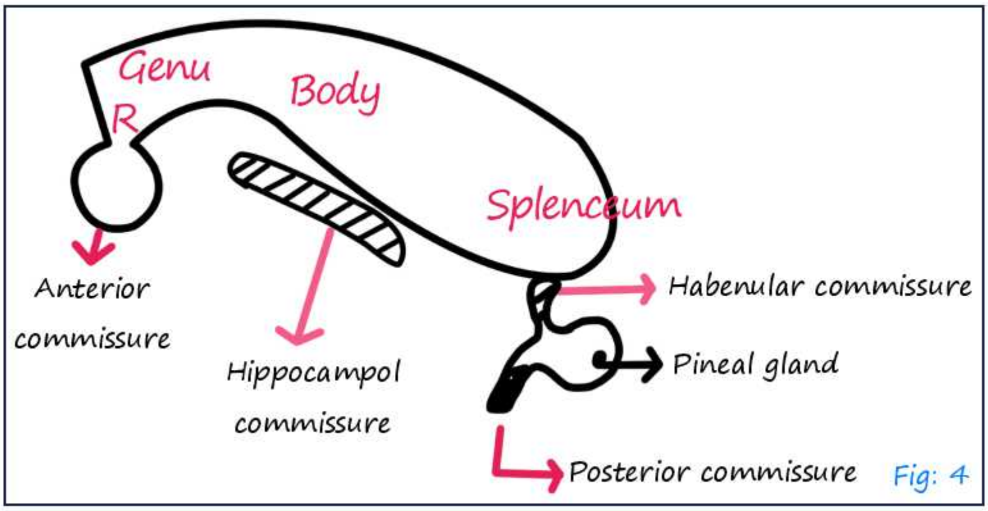

Genu
R
Body
Splenceum
Anterior commissure
Hippocampol commissure
Habenular commissure
Pineal gland
Posterior commissure

Fig: 4

- *Corpus callosum (largest)*
- *Anterior commissure*
- *Posterior commissure*
- *Habenular commissure*
- *Hippocampal commissure*
- *Anterior commissure:*
  - *Connects most anterior part of the temporal lobes*
- *Habenular commissure*
  - *Connects habenula nuclei on both the sides*
- *Posterior commissure*
  - *Connects: - Super colliculi*
    Pretectal nuclei
    Nucleus of Cajal (Accessory oculomotor nucleus)
- *Hippocampal commissure*

DOT TUTORIALS LOGIN FOR SUCCESS

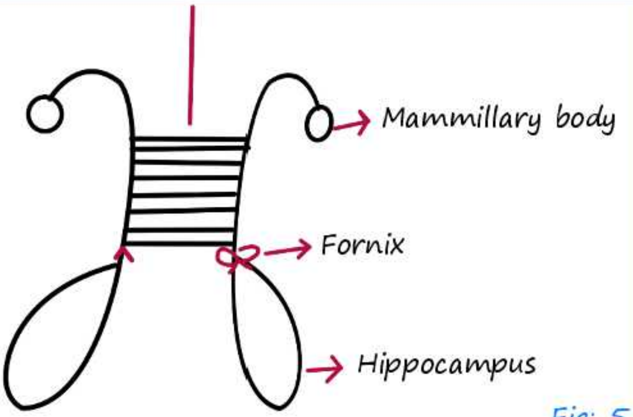

Mammillary body
Fornix
Hippocampus

Fig: 5

TS of cerebrum 00:29:39

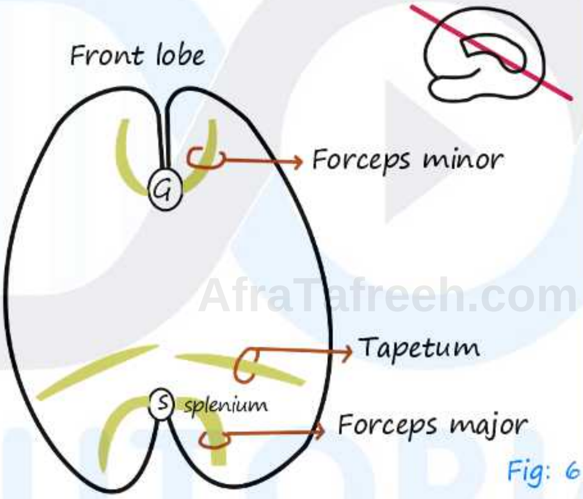

Front lobe
G
Forceps minor
Tapetum
S
splenium
Forceps major

Fig: 6

- Forceps minor → Genu to frontal lobe (4cms from frontal lobe)
- Forceps major → Splenium to occipital lobe (6cms away from occipital lobe)
- Tapetum → Fibres going laterally

White Matter - Projection Fibres Descending Tracts

Projection fibres 00:00:49

- Projection fibres
  - Corona radiata
  - Internal capsule
  - Tracts
    - Descending tracts (motor)
    - Ascending tracts (sensory)

Descending tracts 00:02:41

Overview

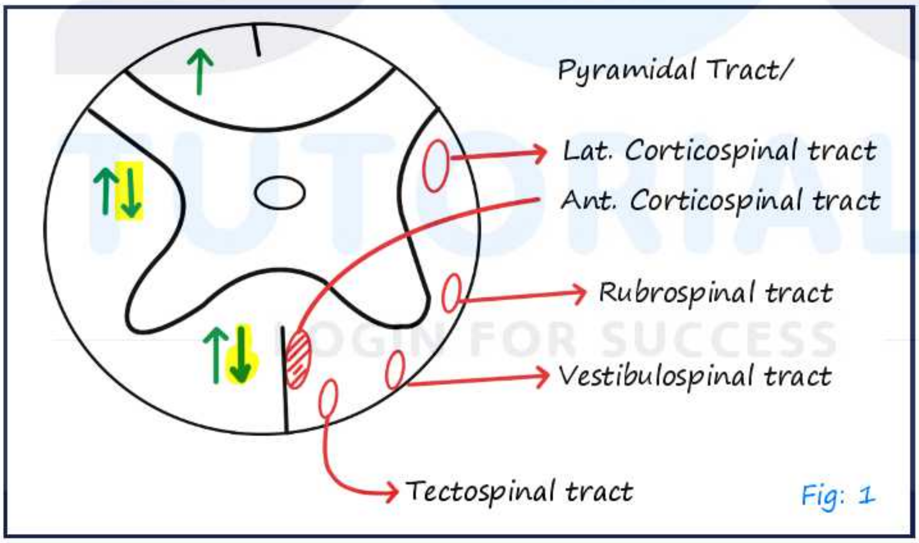

Pyramidal Tract/
Lat. Corticospinal tract
Ant. Corticospinal tract
Rubrospinal tract
Vestibulospinal tract
Tectospinal tract

Fig: 1

Pyramidal/ corticospinal tract

- Lateral corticospinal tract
- Anterior corticospinal tract
  - Motor function
  - Skilled voluntary movements

Extra pyramidal tracts

- Rubrospinal tract – facilitate flexors & inhibits extensors
- Vestibulospinal tract – facilitate extensors & inhibit flexors
- Tectospinal tract – coordinate movements of head & neck and eyeball with reference to visual stimulus

Descending tracts

Pyramidal/ corticospinal tracts

- Motor function
- Skilled voluntary movements

1. Lateral corticospinal tract
2. Anterior corticospinal tract

Extrapyramidal tracts

1. Rubrospinal tract – facilitate flexors and inhibits extensors
2. Vestibulospinal tract – facilitate extensors & inhibit flexors
3. Tectospinal tract

Pyramidal tract/ Corticospinal tracts 00:12:37

Origin: Motor cortex (4,6) (in front of central sulcus)

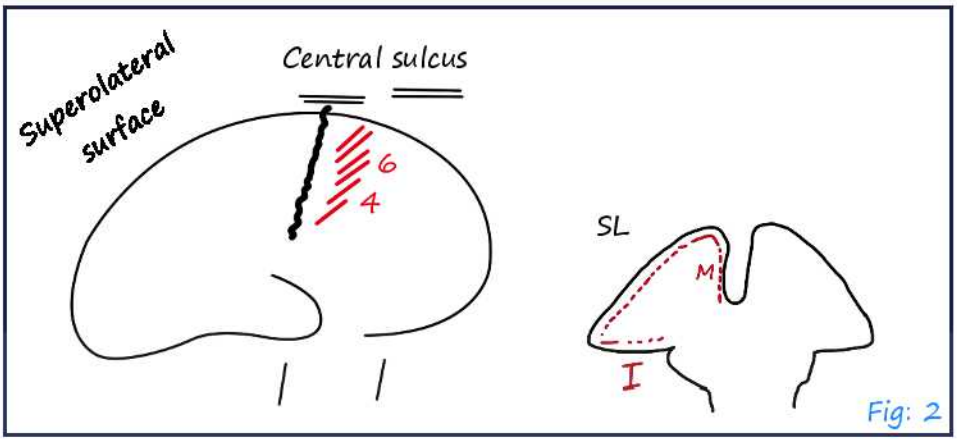
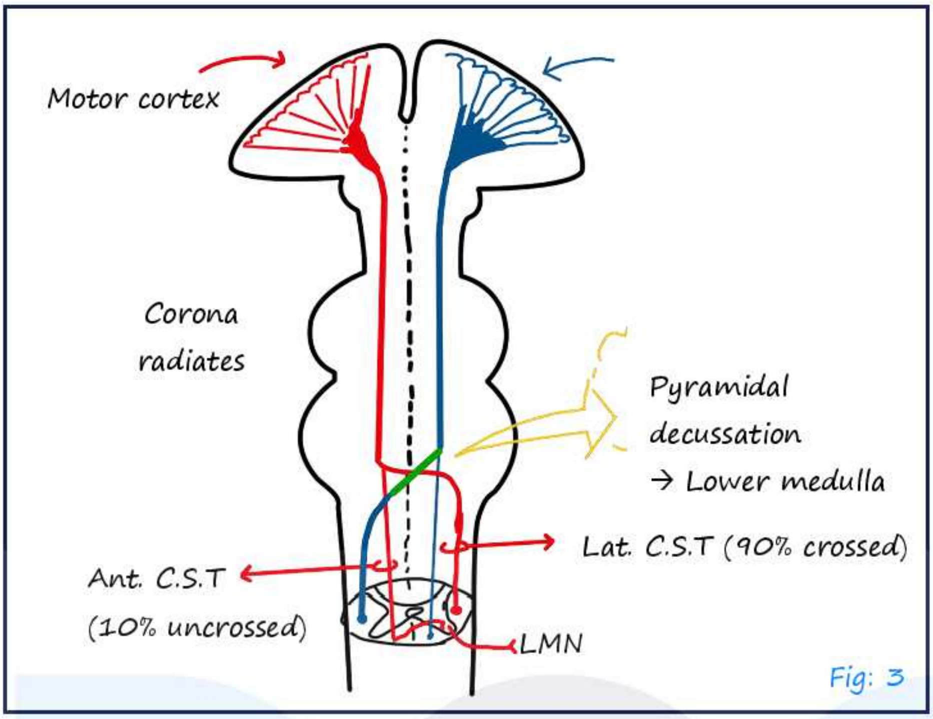


Fig: 2

- Cerebral hemisphere has 3 surfaces
  1.Medial surface
  2.Inferior surface
  3.Superolateral surface
- Superolateral surface has gyri and sulci
- Origin of pyramidal tract → motor cortex (4,6) present in front of the central sulcus – which is present on the superolateral surface of cerebral hemisphere


Motor cortex
Corona radiates
Pyramidal decussation → Lower medulla
Lat. C.S.T (90% crossed)
Ant. C.S.T (10% uncrossed)
LMN
Fig: 3

- Pyramidal decussation → lower medulla
- All the fibres are going to cross; the lower motor neurons (motor nuclei) → present in the ventral horn (There will be contralateral hemiplegia as all the fibres cross)

WHITE MATTER – PROJECTION FIBRES

ASCENDING TRACTS

Ascending tracts: carry sensory information

00:01:30

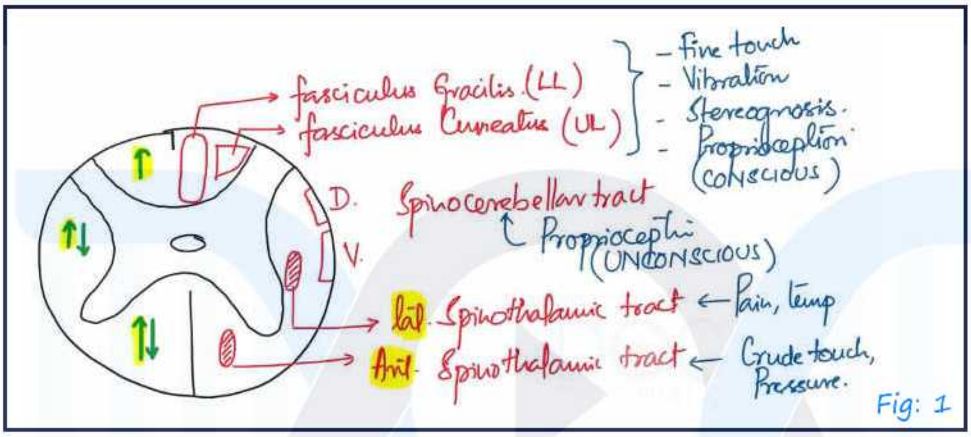

fasciculus Gracilis (LL)
fasciculus Cuneatus (UL)
– Fine touch
– Vibration
– Stereognosis.
– Proprioception (CONSCIOUS)
D.
V.
Spinocerebellar tract
Proprioception (UNCONSCIOUS)
lat. Spinothalamic tract ← Pain, temp
Ant. Spinothalamic tract ← Crude touch, Pressure.

Fig: 1

Ascending tracts (Sensory)

Dorsal column	Lateral column	Anterior column
Only ascending tracts	– Both AT & DT	– Both AT & DT
1. Fasciculus gracilis (lower limb)	1. Lateral spinothalamic tract	1. Anterior spino-thalamic tract
2. Fasciculus cuneatus (upper limb)	2. Spinocerebellar tracts (Dorsal & ventral	
– Fine touch		
– Vibration		
– Stereognosis		
– Proprioception (conscious)		

Spinothalamic tract 00:11:51

- Anterior
- Lateral

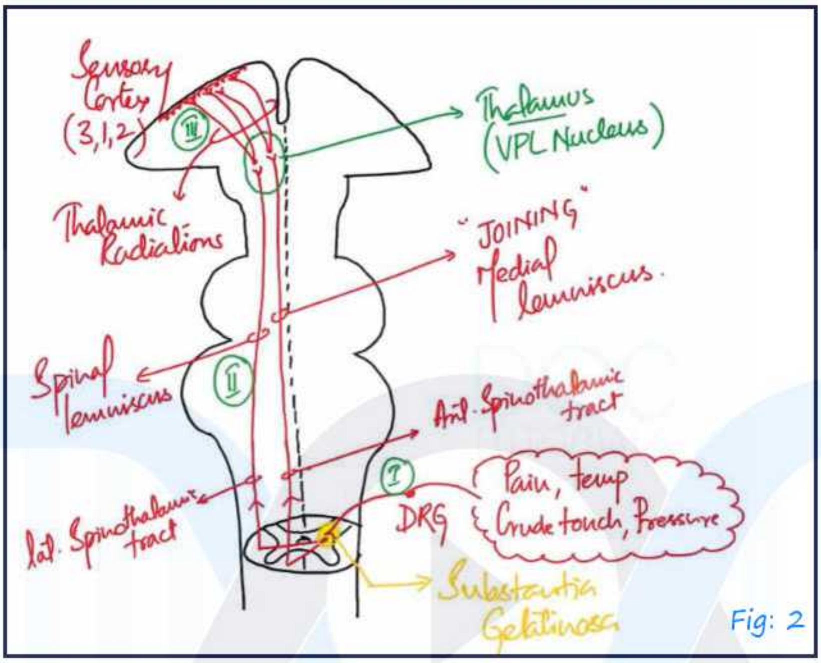

Sensory Cortex (3,1,2)
III
Thalamus (VPL Nucleus)
Thalamic Radiations
"JOINING" Medial lemniscus.
Spinal lemniscus
II
Ant. Spinothalamic tract
I
DRG
Pain, temp Crude touch, Pressure
lat. Spinothalamic tract
Substantia Gelatinosa

Fig: 2

- The spinothalamic tract relays in substantia gelatinosa nucleus in the dorsal horn
- Lateral spinothalamic tract forms the spinal lemniscus
- Spinothalamic tract (spinal + medial lemniscus) end in VPL nucleus (ventral posterolateral) of thalamus
- Thalamic radiations are a part of corona radiata which end in sensory cortex (3,1,2) in cerebral cortex
- Dorsal root ganglion forms the first order neurons (I)
- Tract & lemnisci → second order neurons (II)
- Thalamic radiations → Third order neurons (III)
- Injury or lesion on spinothalamic tract or injury to the lemnisci → loss of sensations (pain, temperature, crude touch & pressure) on the contralateral side

Dorsal column tract 00:25:30

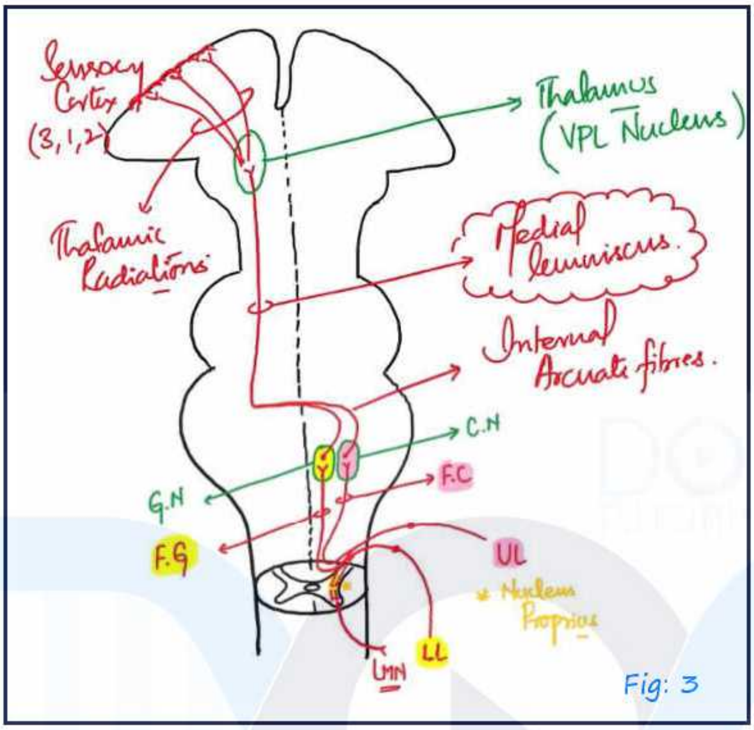

Sensory Cortex (3,1,2)
Thalamus (VPL Nucleus)
Thalamic Radiations
Medial lemniscus.
Internal Arcuate fibres.
C.N
F.C
G.N
F.G
UL
* Nucleus Proprius
LL
LMN

Fig: 3

- F.G – Gracilis Nucleus (ends)
- F.C – Cuneatus Nucleus (ends)

end in medulla oblongata

- The fibres from the medulla cross and go on the other side to form medial lemniscus in the brain stem
- The crossing of fibres – Internal arcuate fibres
- Medial lemniscus ends in the VPL nucleus of thalamus, from here the fibres end in sensory cortex (3,1,2)
- Medial lemniscus
  - Anterior spinothalamic tract joins the medial lemniscus
- The fibres from upper and lower limbs enter the white matter (dorsal column)
- Nucleus proprius – (flow fibres) → ventral horn → lower motor neurons

Spinocerebellar tract 00:35:50

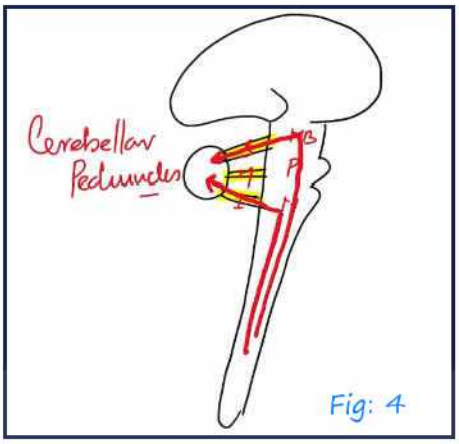

Cerebellar Peduncles
B
P
I

Fig: 4

- Superior cerebellar peduncle → Midbrain to cerebellum
- Middle cerebellar peduncle → Pons to cerebellum
- Inferior cerebellar peduncle → Medulla to cerebellum

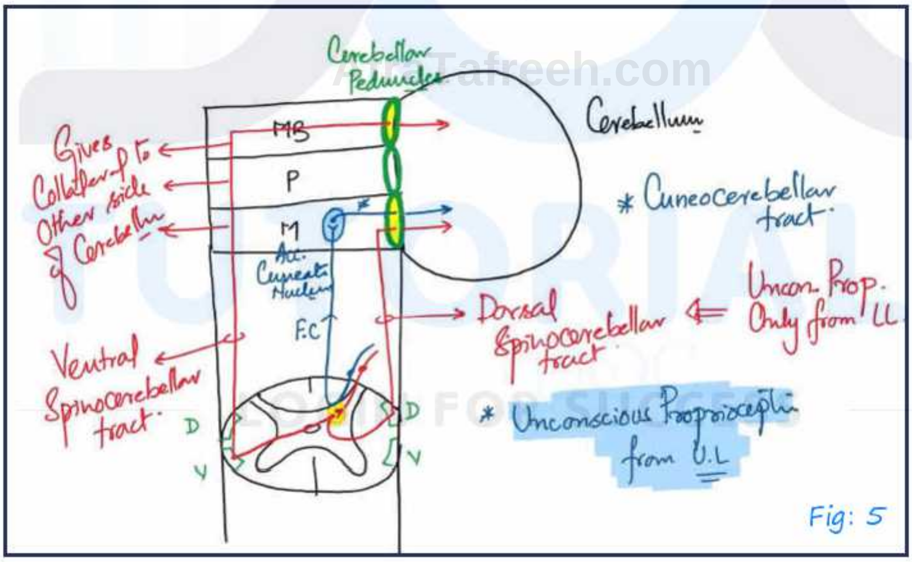

Cerebellar Peduncles
Cerebellum
MB
P
M
Gives Collateral to Other side of Cerebellum
Acc. Cuneate Nucleus
F.C
* Cuneocerebellar tract.
Uncon. Prop. Only from LL
Dorsal Spinocerebellar tract
Ventral Spinocerebellar tract.
D
V
D
V
* Unconscious Proprioception from U.L

Fig: 5

- Some of the fibres from nucleus dorsalis/ Clarke's nucleus will cross → forming the ventral spinocerebellar tract
- Fibres on the same side → dorsal spinocerebellar tract (do not cross)

- Ventral spinocerebellar tract – enters the cerebellum
  – via superior cerebellar peduncle (other side)
- Dorsal spinocerebellar tract (same side) $\xrightarrow[\text{peduncle}]{\text{Inferior cerebellar}}$ cerebellum
- Ventral spinocerebellar tract has bilateral representation
- Dorsal spinocerebellar tract → unconscious proprioception from lower limb only
- Unconscious proprioception from the upper limb → enters into dorsal root ganglion → ascends into the medulla → combines along with fasciculus cuneatus → and ends separately in accessory cuneate nucleus → enters the cerebellum called cuneocerebellar tract through the inferior cerebellar peduncle

DOC TUTORIALS LOGIN FOR SUCCESS

Clinical aspects 00:49:40

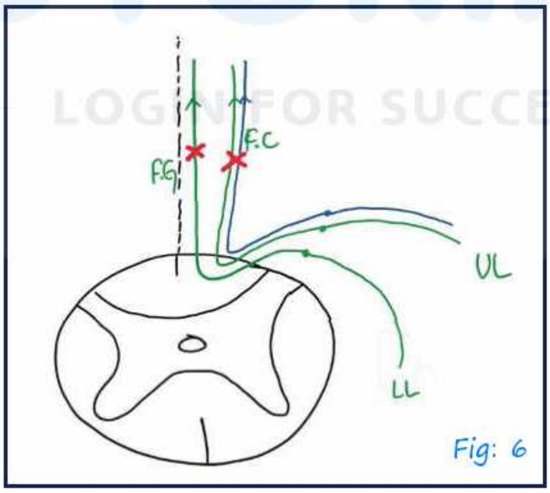


Fig: 6

- Injury to fasciculus gracilis
  – Ipsilateral loss of conscious proprioception from lower limb

- Injury to fasciculus cuneatus
  - Ipsilateral loss of conscious & unconscious proprioception from upper limb

Grey matter of spinal cord 00:54:51

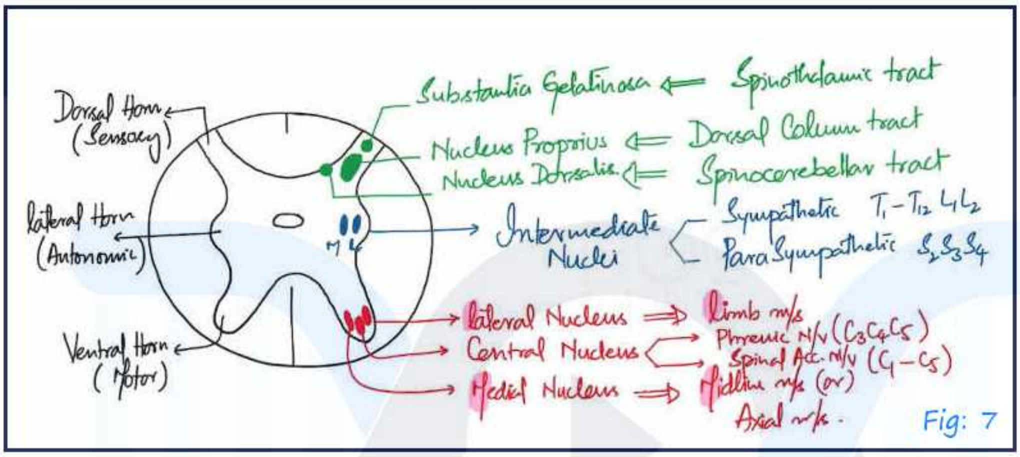

Dorsal Horn
(Sensory)
lateral Horn
(Autonomic)
Ventral Horn
(Motor)
Substantia Gelatinosa ⇐ Spinothalamic tract
Nucleus Proprius ⇐ Dorsal Column tract
Nucleus Dorsalis ⇐ Spinocerebellar tract
M L
Intermediate Nuclei
Sympathetic $T_1 - T_{12}$ $L_1 L_2$
Para Sympathetic $S_2 S_3 S_4$
lateral Nucleus ⇒ limb m/s
Central Nucleus
Phrenic N/v ($C_3 C_4 C_5$)
Spinal Acc. N/v ($C_1 - C_5$)
Medial Nucleus ⇒ Midline m/s (or) Axial m/s.

Fig: 7

BRODMANN AREA

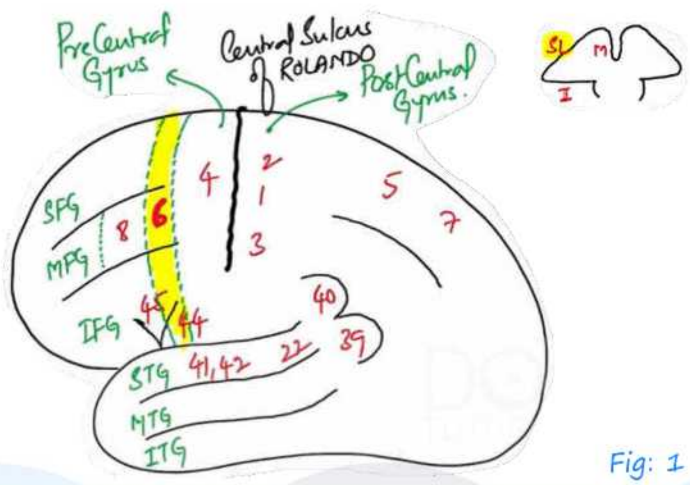

PreCentral Gyrus
Central Sulcus of ROLANDO
PostCentral Gyrus.
SL
M
I
4
2
1
3
5
7
SFG
8
6
MFG
IFG
45
44
40
39
STG
41,42
22
MTG
ITG

Fig: 1

DG TUTORIALS LOGIN FOR SUCCESS

Supero-lateral Surface of cerebral hemisphere

Name	Location
Primary Auditory Area-41,42	Superior Temporal Gyrus (HESCHL's Gyrus)
Auditory Association Area – 22	Superior Temporal Gyrus
Primary Motor Area – 4	Pre-Central Gyrus
Primary Motor Area – 6	Superior Frontal Gyrus Middle Frontal Gyrus Inferior Frontal Gyrus
Broca's Speech Area – 44 (pars opercularis) 45 (pars Triangularis)	Inferior Frontal Gyrus
Wernicke's Speech Area -22, (sensory) 39 40	Superior Temporal Gyrus Angular Gyrus Supramarginal Gyrus
Primary Sensory Area – 3, 1, 2	Post Central Gyrus
Sensory Association Area – 5, 7	Superior Parietal Lobule
Primary visual area – 17	Occipital lobe
Visual Association area -18, 19	

Medial Surface of Cerebral Hemisphere 00:18:01

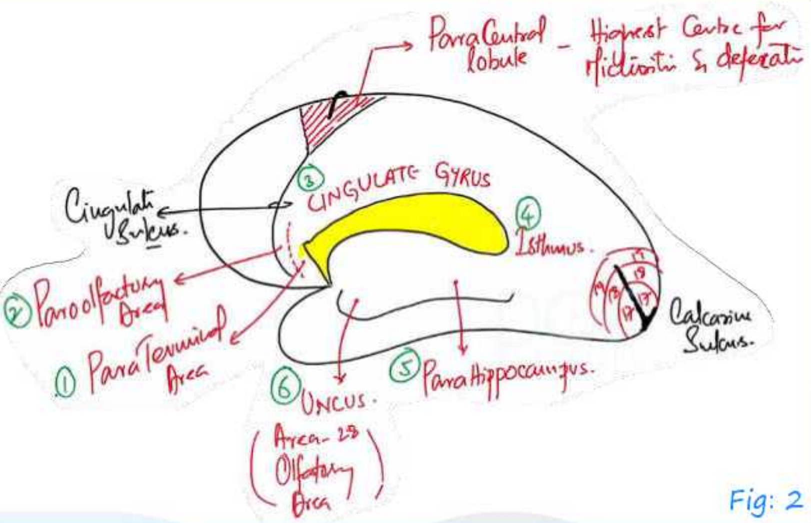

Para Central lobule - Highest Centre for Micturition & defecation
Cingulate Sulcus.
③ CINGULATE GYRUS
④ Isthmus.
② Paraolfactory Area
① Para Terminal Area
⑥ UNCUS.
(Area-28 Olfactory Area)
⑤ Para Hippocampus.
17
18
19
Calcarine Sulcus.

Fig: 2

- Cingulate gyrus is connected with the para-Hippocampus through the Isthmus.

Components of Limbic System 00:23:33

- Para Terminal Area
- Para Olfactory Area
- Cingulate Gyrus
- Isthmus
- Para hippocampus
- Uncus

TUTORIALS LOGIN FOR SUCCESS

VENTRAL & DORSAL ASPECT OF BRAINSTEM

VENTRAL

Brainstem 00:00:41

1. Mid brain
2. Pons
3. Medulla oblongata

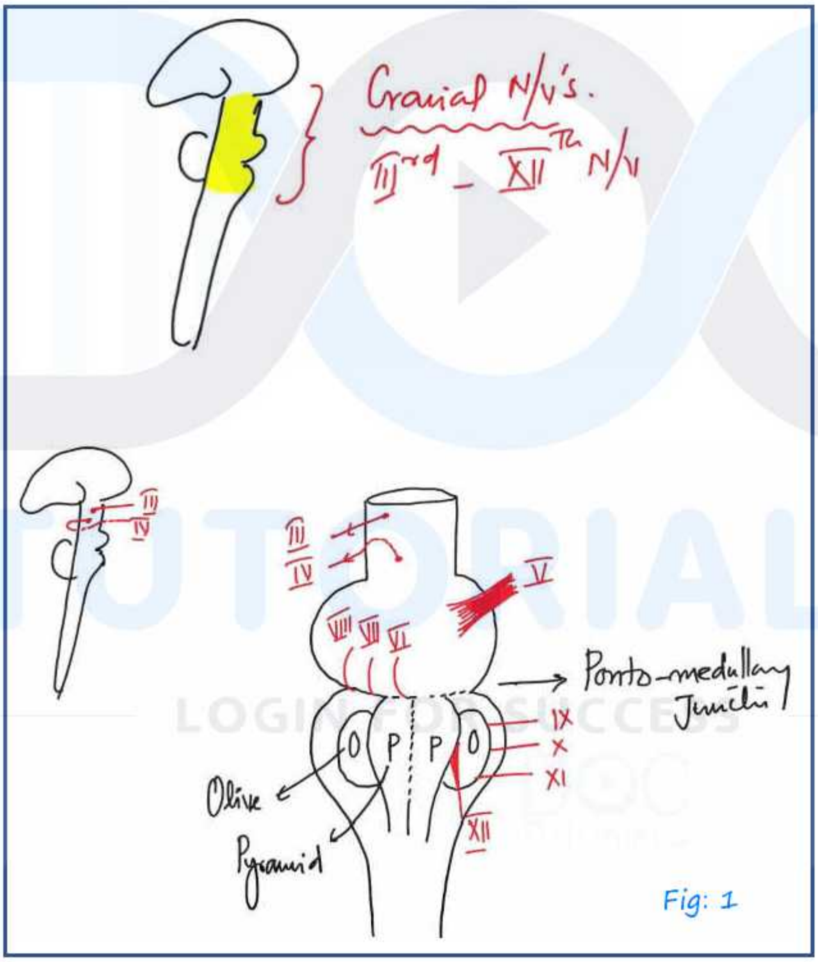

Cranial N/v's.
III rd – XII Th N/v
III
IV
III
IV
V
VIII VII VI
Ponto-medullary Junction
IX
X
XI
O P P O
Olive
Pyramid
XII

Fig: 1

- III – Ventral & IV – Dorsal → exit out from mid-brain
- Only cranial nerve with dorsal origin → IV CN (trochlear)
- PONS → V CN (Trigeminal) → Thickest and largest CN

- Ponto-medullary junction → VI, VII and VIII CN
- Medulla oblongata
  - From olive → IX, X, XI CN
  - Between the pyramid & olive → XII CN

Ventral aspect of brainstem 00:09:40

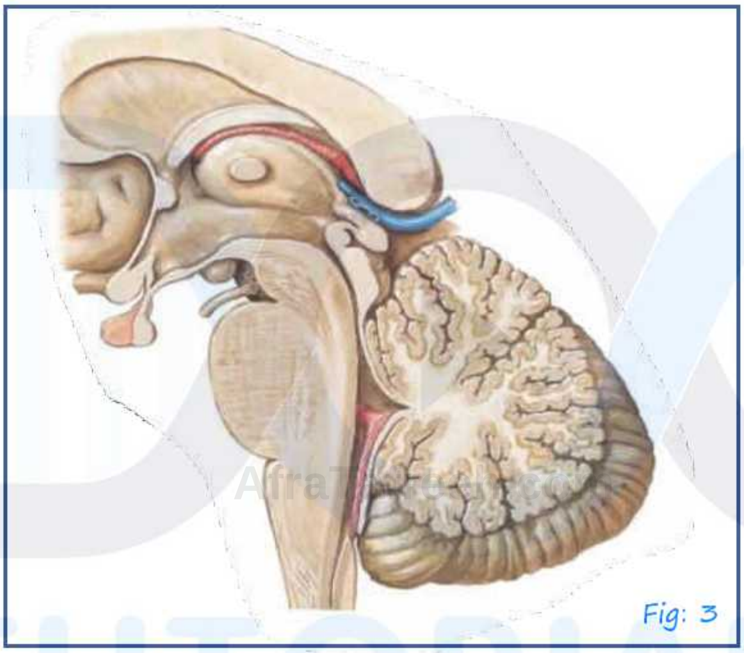


Fig: 3

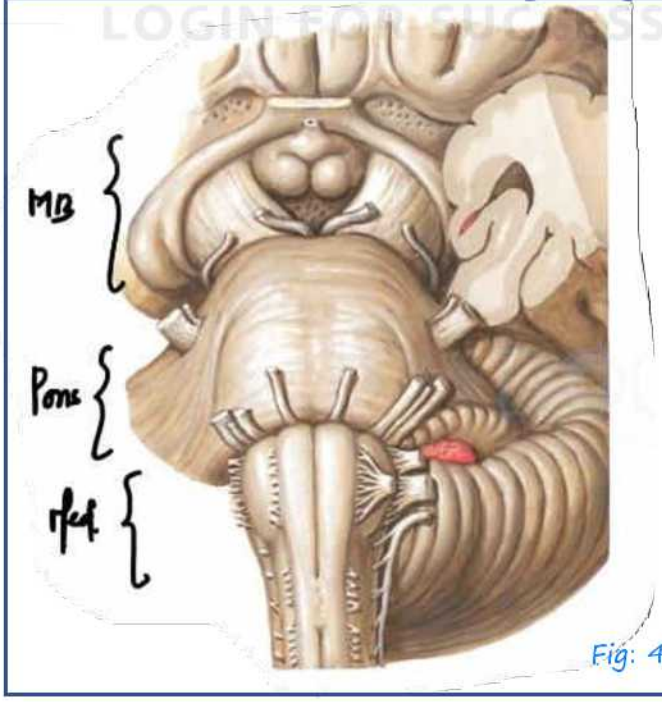


Fig: 4

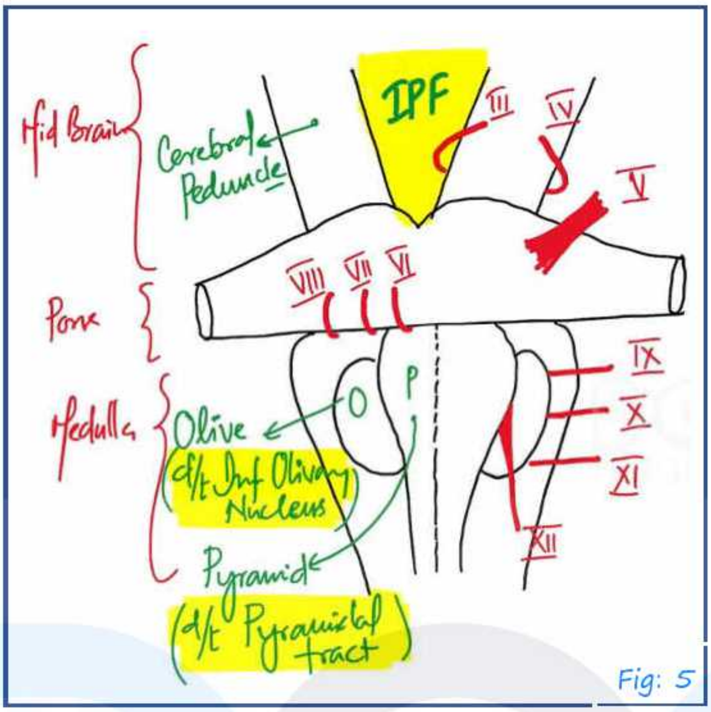

Mid Brain
Pons
Medulla
Cerebral Peduncle
IPF
III
IV
V
VIII
VII
VI
IX
X
XI
XII
O
P
Olive
(d/t Inf Olivary Nucleus)
Pyramid
(d/t Pyramidal tract)

Fig: 5

- Olive → due to inferior olivary nucleus
- Pyramid → due to pyramidal tract
  - Injury or lesion → Contralateral hemiplegia

DOC TUTORIALS LOGIN FOR SUCCESS

Interpeduncular fossa 00:15:37

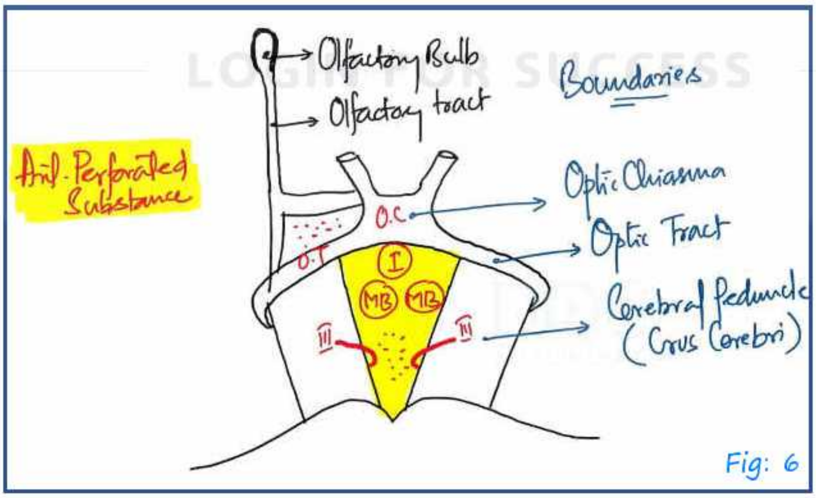

Olfactory Bulb
Olfactory tract
Boundaries
Ant. Perforated Substance
O.C
O.T
Optic Chiasma
Optic Tract
I
MB
MB
III
III
Cerebral peduncle (Crus Cerebri)

Fig: 6

Contents

- Infundibulum + tuber cinereum
- Mamillary body
- Posterior perforated substance
- CN – III

Boundaries of anterior perforated substance

- Medial side – Optic chiasma
- Posterior – Optic tract
- Lateral – Limen insulae

DOC TUTORIALS LOGIN FOR SUCCESS

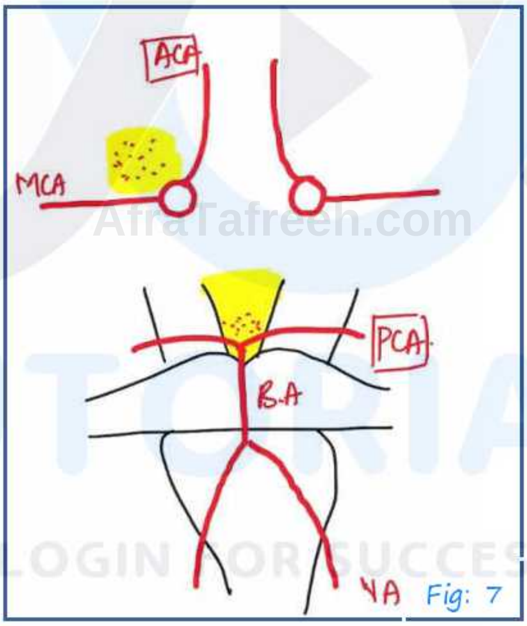


Fig: 7

- Posterior perforated substance
  - Branches of posterior cerebral artery perforating the grey matter
- Anterior perforated substance
  - Branches of anterior and middle cerebral arteries perforating the grey matter

Dorsal Aspect of Brainstem

- Superior colliculi

  (Visual) SC SC

- Inferior colliculi

  (Auditory) IC IC

] Corpora Quadrigemina

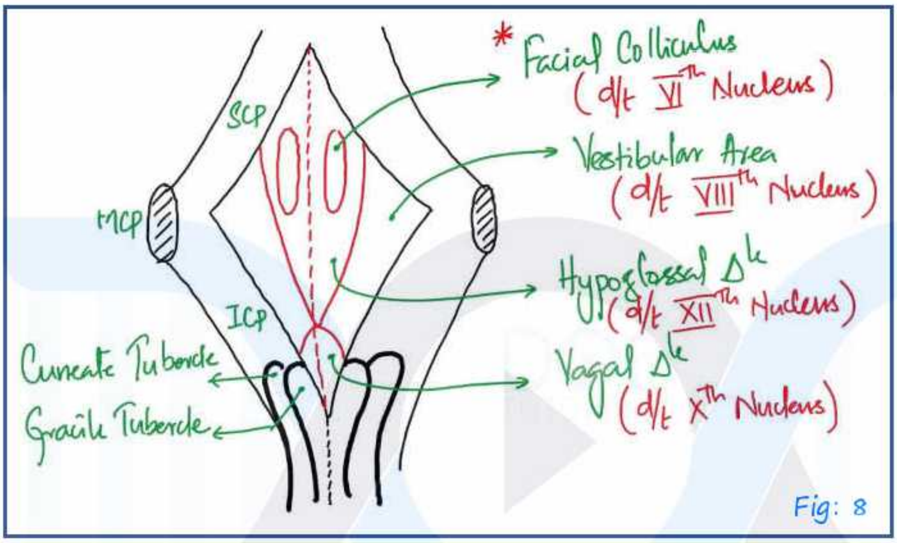

SCP
MCP
ICP
Cuneate Tubercle
Gracile Tubercle
* Facial Colliculus
(d/t VI^th Nucleus)
Vestibular Area
(d/t VIII^th Nucleus)
Hypoglossal Δ^le
(d/t XII^th Nucleus)
Vagal Δ^le
(d/t X^th Nucleus)

Fig: 8

- Vagal triangle – due to X CN nucleus
- Hypoglossal triangle – due to XII CN nucleus
- Vestibular area – due to VII CN nucleus
- Facial colliculus – due to VI CN nucleus (Abducens)

Transverse section of the pons 00:15:49

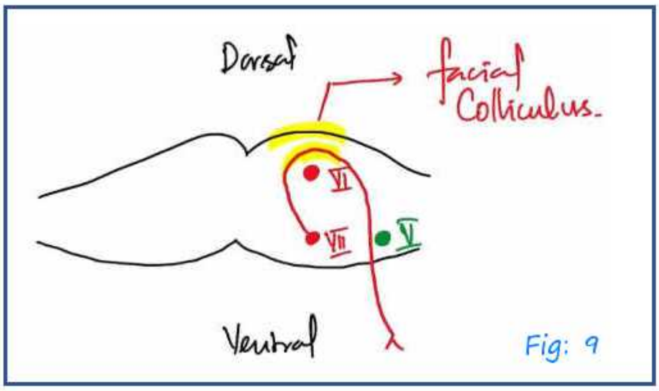

Dorsal
facial Colliculus.
VI
VII
V
Ventral

Fig: 9

- Facial colliculus –
  - Due to VI nucleus
  - Due to VII nerve
- Floor of fourth ventricle or rhomboid fossa

Fourth ventricle 00:19:57

Boundaries:

- Laterally
  - Superior and inferior cerebellar peduncles
  - Gracile and cuneate tubercle

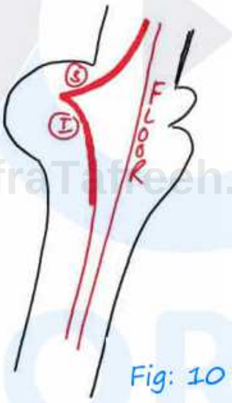


Fig: 10

- Floor: – Rhomboid fossa
- Roof
  - Superior medullary velum (Nervous-white matter)
  - Inferior medullary velum (non-nervous).

CRANIAL NERVE NUCLEI

Cranial Nerve Nuclei and Columns 00:00:36

Motor Nuclei/Efferent Column –

1. GSE – General somatic efferent → Extra ocular muscles and Tongue muscles.
2. SVE – Special visceral/Efferent → Muscles of P. Arches
   "Branchial"
   - 1 – V_3 – Muscles of mastication
   - 2 – VII – Muscles of facial expression
   - 3 – IX] Muscles of:
   - 4]– X]
     - Pharynx
     - Larynx
   - 6]
     - Palate
3. GVE – General visceral efferent → smooth muscles and glands

Sensory nuclei/afferent column: –

1. GVA – General visceral afferent ← General sensation from Tongue
2. SVA – Special visceral afferent ← Taste sensation from tongue
3. GSA – General Somatic afferent ← General Sensation From body wall

Parasympathetic column

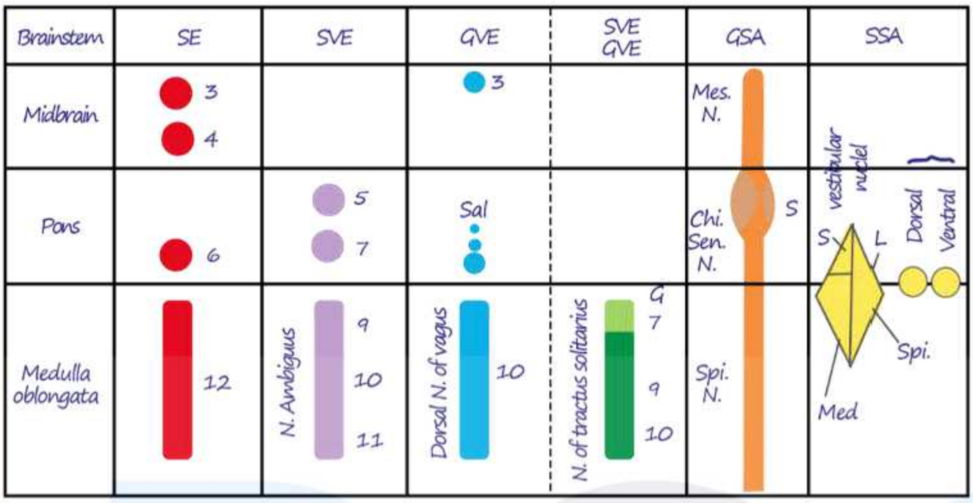

Brainstem
SE
SVE
GVE
SVE GVE
GSA
SSA
Midbrain
Pons
Medulla oblongata
3
4
6
12
5
7
N. Ambiguus
9
10
11
3
Sal
Dorsal N. of vagus
10
N. of tractus solitarius
G
7
9
10
Mes. N.
Chi. Sen. N.
S
Spi. N.
vestibular nuclei
Dorsal
Ventral
S
L
Spi.
Med

Fig: 1

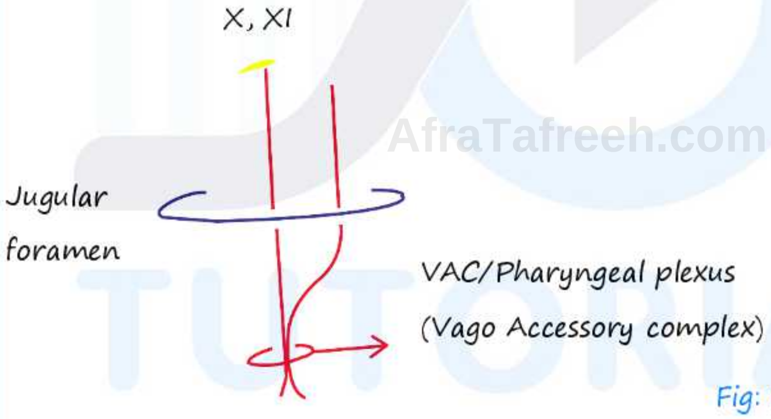
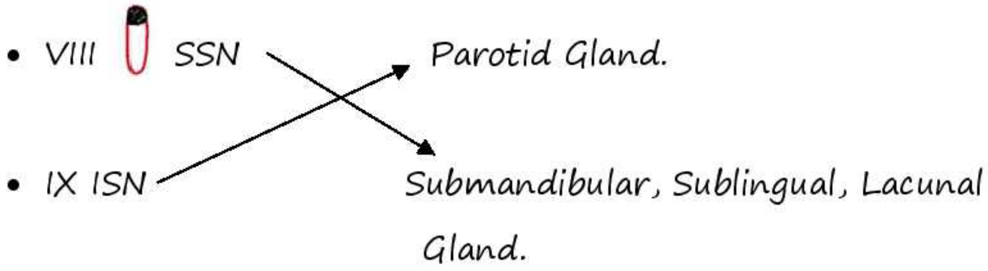

X, XI
Jugular foramen
VAC/Pharyngeal plexus
(Vago Accessory complex)

Fig: 2

LN (Lacrimatory nucleus)



- VIII SSN → Submandibular, Sublingual, Lacunal Gland.
- IX ISN → Parotid Gland.

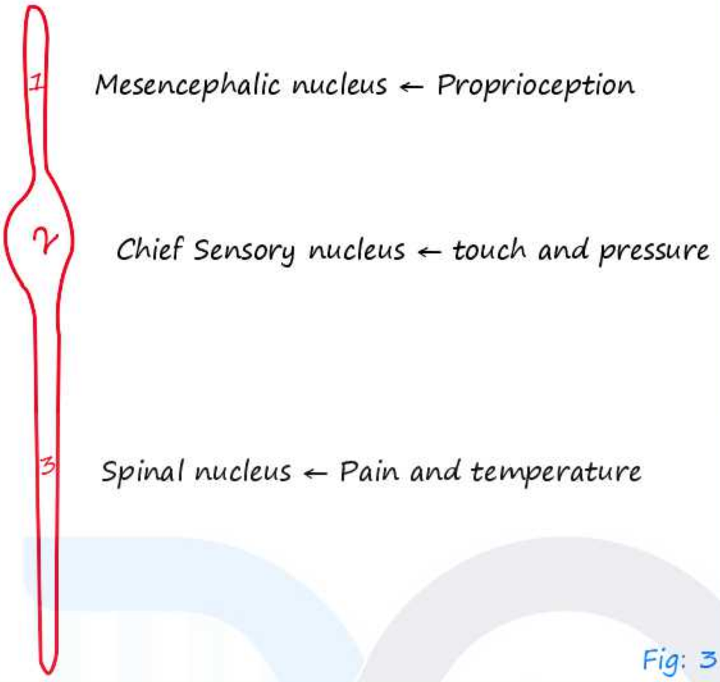

1
Mesencephalic nucleus ← Proprioception
2
Chief Sensory nucleus ← touch and pressure
3
Spinal nucleus ← Pain and temperature

Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS

LATERAL VENTRICLES & 3RD VENTRICLE

Coronal section of the brain 00:00:05

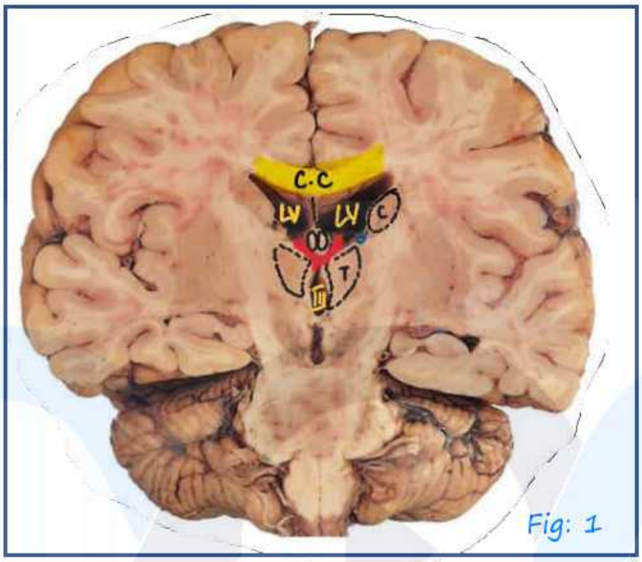

C.C
LV
LV
C
T
III

Fig: 1

TUTORIALS
LOGIC FOR SUCCESS

Lateral ventricle

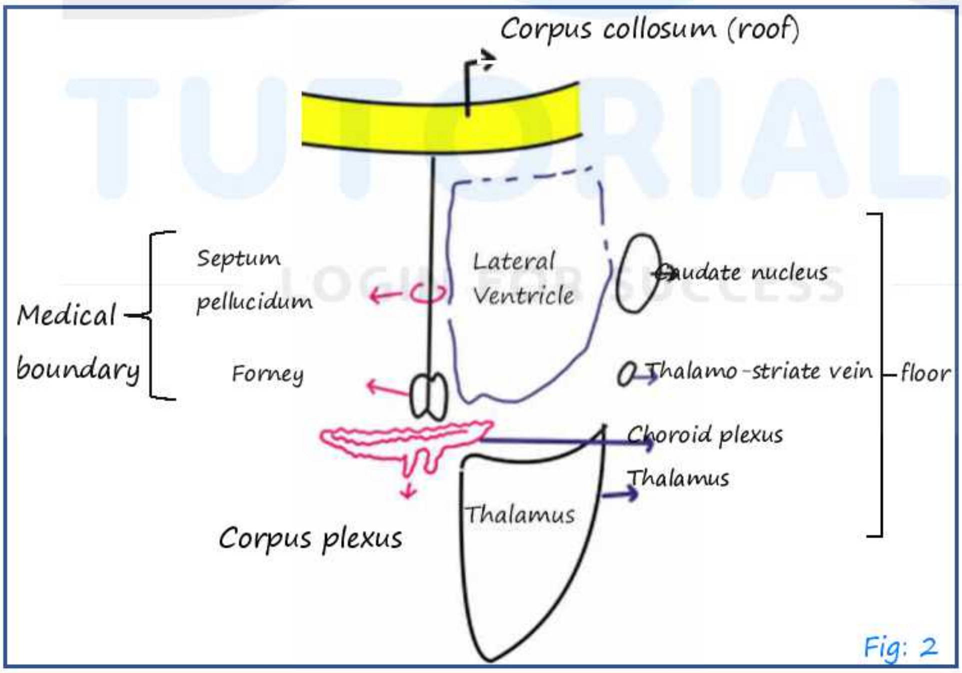

Corpus collosum (roof)
Medical boundary
Septum pellucidum
Forney
Lateral Ventricle
Caudate nucleus
Thalamo-striate vein
floor
Choroid plexus
Thalamus
Thalamus
Corpus plexus

Fig: 2

- Roof – Corpus callosum
- Medial boundary

  - Septum pellucidum
  - Fornix
- Floor
  - Caudate nucleus
  - Thalamostriate vein
  - Choroid plexus
  - Thalamus
- Lateral wall
  - Not present in lateral ventricle

Sagittal section of third ventricle 00:09:25

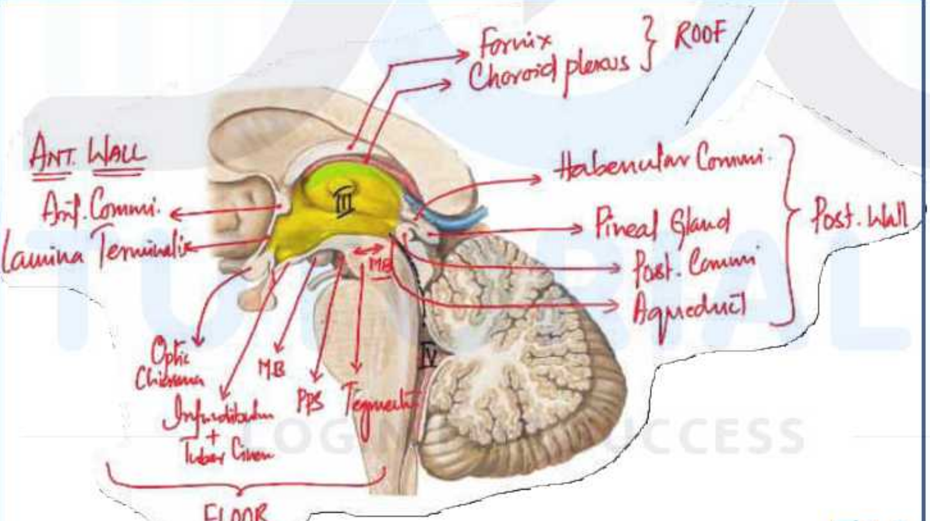

Fornix
Choroid plexus
ROOF
ANT. WALL
Ant. Commi.
Lamina Terminalis
III
Habenular Commi.
Pineal Gland
Post. Commi
Aqueduct
Post. Wall
MB
Optic Chiasma
MB
PPS
Tegmentum
Infundibulum + Tuber Cinereum
IV
FLOOR

Fig: 3

Boundaries

- Roof
  - Fornix
  - Choroid plexus
- Anterior wall
  - Anterior commissure

  - Lamina terminalis
- Posterior wall
  - Habenular commissure
  - Pineal gland
  - Posterior commissure
  - Aqueduct od sylvius
- Floor
  - Optic chiasma
  - Infundibulum + tuber cinereum
  - Mammillary body
  - Tegmentum
- Laterally
  - Thalamus & hypothalamus

BLOOD SUPPLY OF BRAIN

- Blood Supply of Brain:

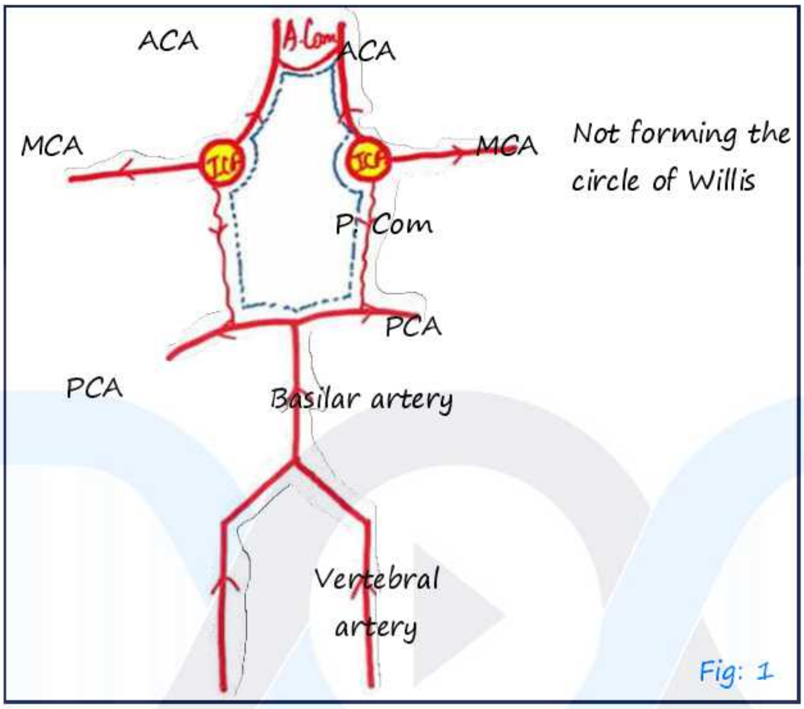

ACA
A.Com
ACA
MCA
ICA
ICA
MCA
Not forming the circle of Willis
P. Com
PCA
PCA
Basilar artery
Vertebral artery

Fig: 1

Arteries forming circle of Willis:

1. Posterior Cerebral artery (PCA)
2. Posterior Communicating artery
3. Internal Carotid artery (ICA)
4. Anterior Cerebral artery (ACA)
5. Anterior Communicating artery
   - → Middle Cerebral artery → does not form circle of Willis.

TUTORIALS LOGIN FOR SUCCESS

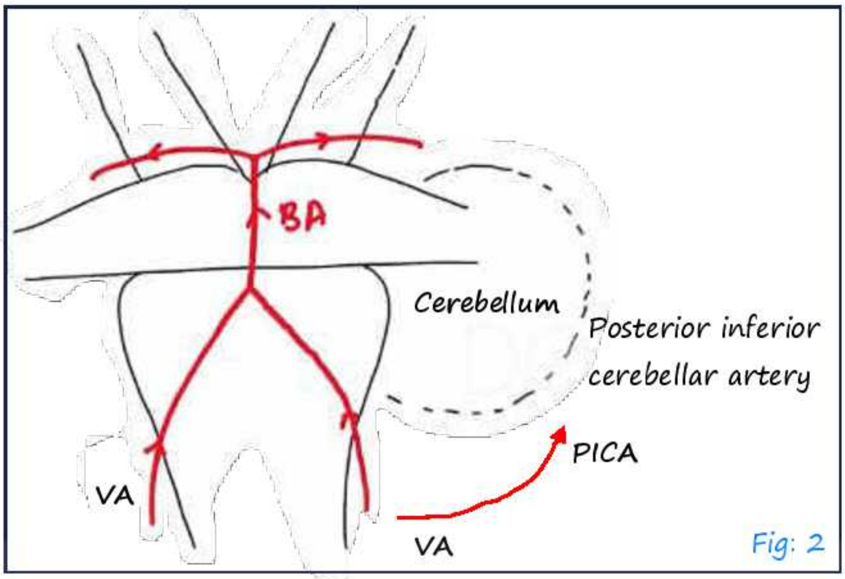
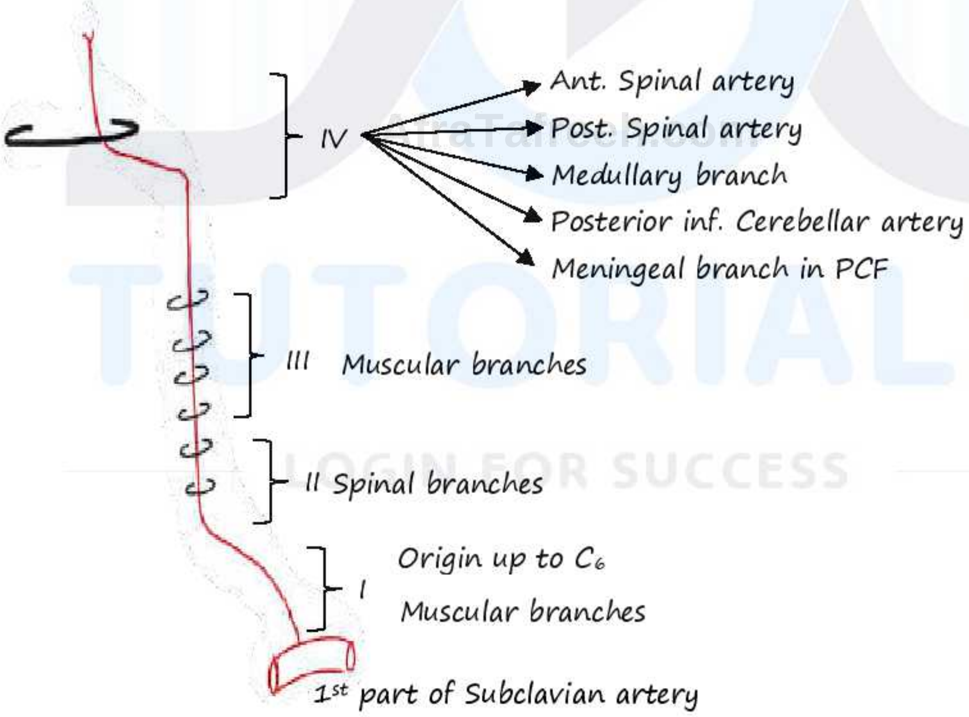
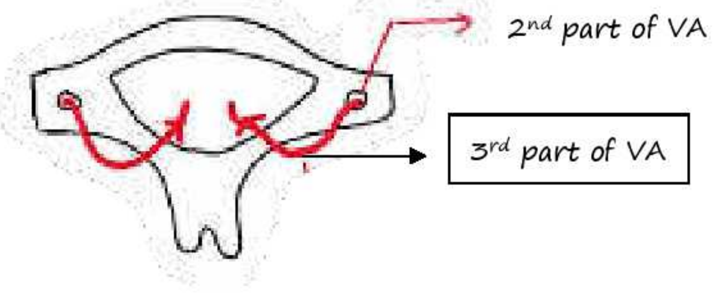

BA
Cerebellum
Posterior inferior cerebellar artery
PICA
VA
VA

Fig: 2

Vertebral artery: 00:10:39

- Branch of 1st part of Subclavian artery. (VIT)


IV
Ant. Spinal artery
Post. Spinal artery
Medullary branch
Posterior inf. Cerebellar artery
Meningeal branch in PCF
III Muscular branches
II Spinal branches
I
Origin up to C6
Muscular branches
1st part of Subclavian artery


2nd part of VA
3rd part of VA

Basilar Artery: Located on Pons 00:23:10

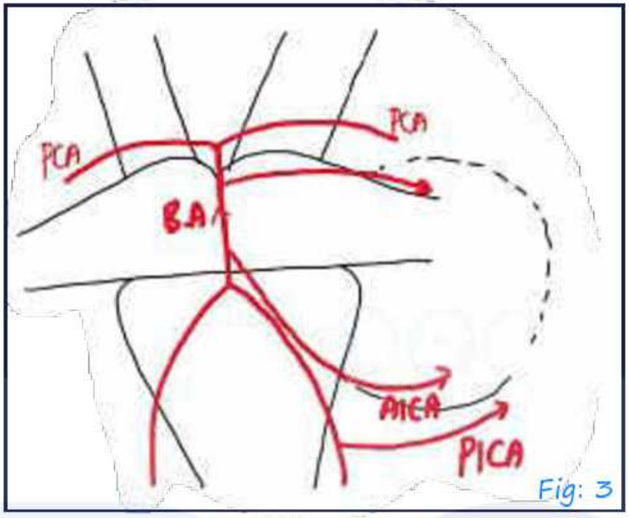


Fig: 3

1.Posterior Cerebral artery (PCA)
2.Superior Cerebellar artery
3.Anterior Inferior Cerebellar artery (AICA)
4.Pontine branch

- AICA (Anterior Inferior Cerebellar artery) ← Basilar Artery
- PICA (posterior Inferior Cerebellar artery ← Vertebral artery
- Labyrinthine artery is a branch of AICA (AICA > Basilar artery)
- III CN & IV CN are present in between PCA (Posterior cerebral artery) and SCA (Superior cerebellar artery)

Internal Carotid Artery: 00:28:56

1.Anterior Cerebral artery (ACA)
2.Middle Cerebral artery (MCA)
3.Posterior Communicating artery
4.Ophthalmic artery (First branch)

5.Anterior Choroidal artery

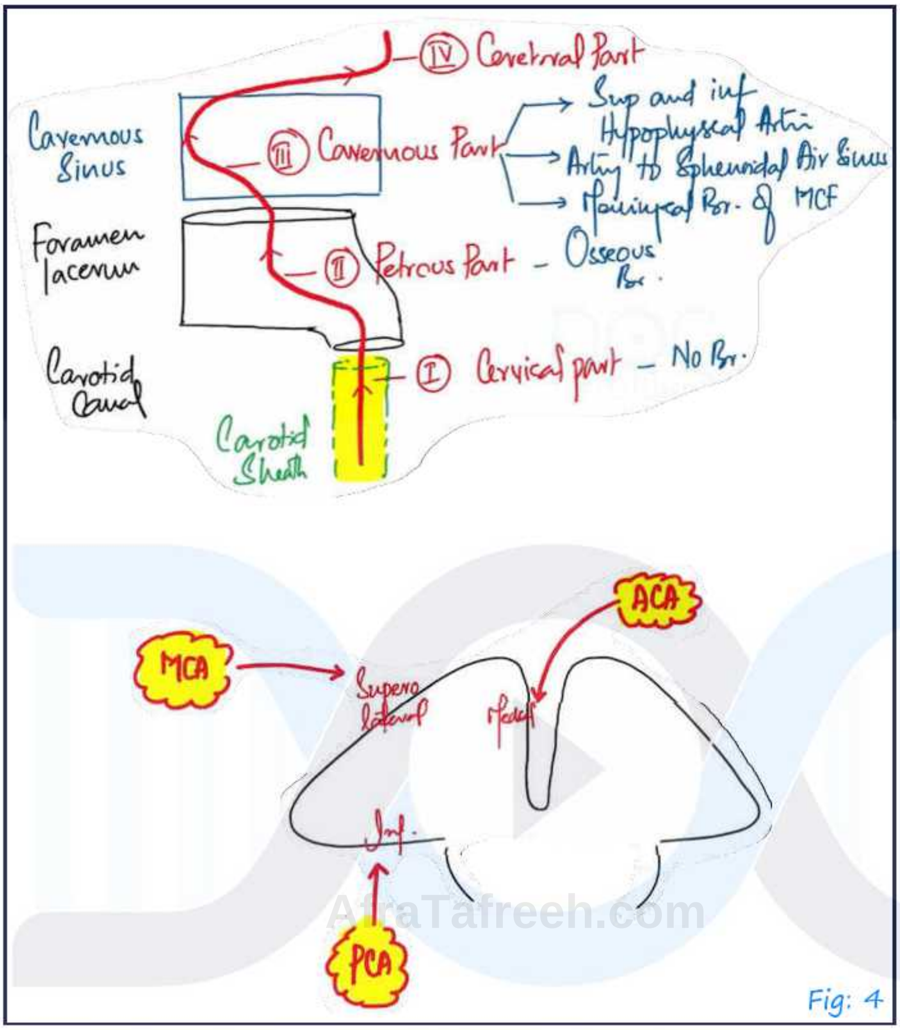

IV Cerebral Part
Cavernous Sinus
III Cavernous Part
Sup and inf Hypophyseal Arti
Artry to Sphenoidal Air Sinus
Meningeal Br. of MCF
Foramen lacerum
II Petrous Part - Osseous Br.
Carotid Canal
I Cervical part - No Br.
Carotid Sheath
ACA
MCA
Supero lateral
Medial
Inf.
PCA

Fig: 4

DOC TUTORIALS
LOGIN FOR SUCCESS

BASAL GANGLIA INTERNAL CAPSULE

Basal ganglia 00:00:35

Structures forming in basal ganglia

i. Structural components

- It includes
  - Corpus striatum/Wilson's pencil (present in telencephalon)
  - It is made up of 2 structures

Caudate nucleus | **Lentiform nucleus**

↓

This in-turn is made up of

Putamen | **Globus pallidum**

- Putamen and globus pallidum are separated from each other by external medullary lamina.
- Globus pallidum is further divided into 2 parts

Inturnus | **Externus**

- And these 2 are separated by internal medullary lamina

- The caudate nucleus and the putamen are the parts of neostriatum.

- Globus pallidum is a part of paleostriatum

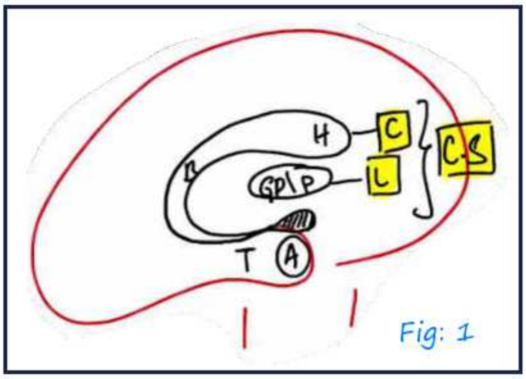

H
C
L
CS
B
GP/P
T
A

Fig: 1

C – Caudate nucleus
H – Head
B – Body
T – Tail

A – Amygdyla
GP/P – Globus pallidus/Putamen
L – Lentiform nucleus
C – Caudate nucleus

L, C – CS – Carpus striatum

ii. Functional components

- Subthalamic nucleus (present in diencephalon)
- Substance nigra (in mesencephalon)
- Red nucleus (in mesencephalon)

AlaaTafreeh.com
TUTORIALS
LOGIN FOR SUCCESS

T.S of cerebrum 00:13:50

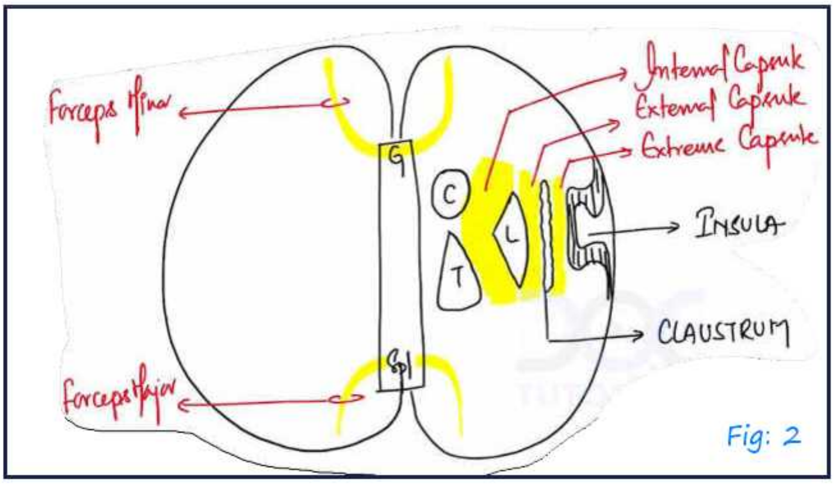

Forceps Minor
Internal Capsule
External Capsule
Extreme Capsule
G
C
L
T
Insula
Claustrum
Spl
Forceps Major

Fig: 2

Internal capsule 00:17:33

- It is a bundle of fibres which is connecting the cerebral cortex with remaining part of the brain and spinal cord
- They have both ascending and descending fibres

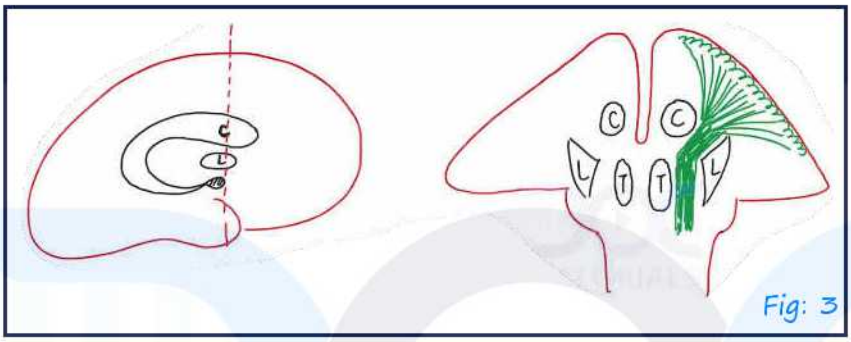


Fig: 3

Parts of internal capsule

- They have 5 parts
  - Anterior limb
  - Posterior limb
  - Genu
  - Retro-lentiform
  - Sub-lentiform

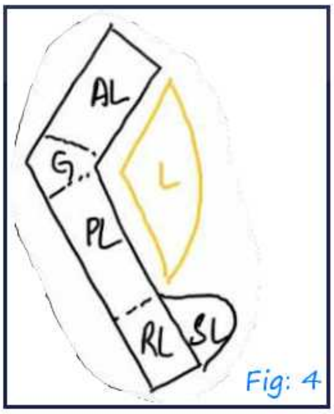


Fig: 4

Relations

- Laterally – lentiform nucleus
- Medially – caudate nucleus and thalamus
  - Anterior limb is between lentiform nucleus and caudate nucleus
  - Posterior limb is between lentiform nucleus and thalamus

Tracts passing through internal capsule 00:22:56

Ascending tract

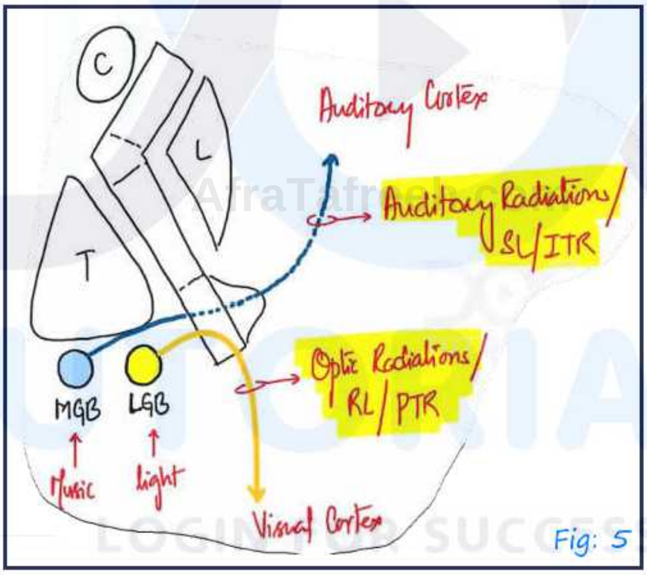

C
L
T
Auditory Cortex
Auditory Radiations/ SL/ITR
Optic Radiations/ RL/PTR
MGB
LGB
Music
light
Visual Cortex

Fig: 5

- PTR – Posterior thalamic radiation
- ITR – Inferior thalamic radiation
- ATR – Anterior thalamic radiation
- STR – Superior thalamic radiation
  - Optic radiations pass through the retro lentiform part of internal capsule

- Auditory radiations pass through the sub-lentiform part of internal capsule and goes to the auditory cortex

Descending tracts

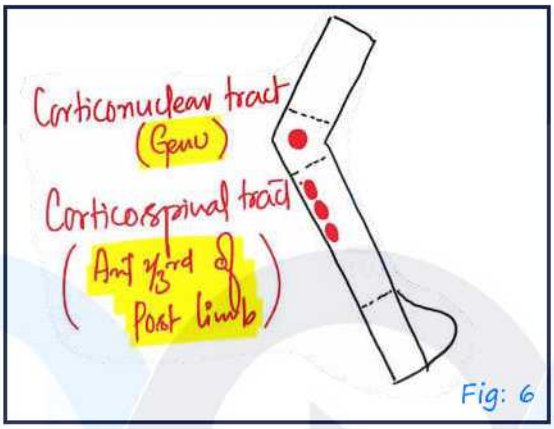

Corticonuclear tract
(Genu)
Corticospinal tract
(Ant 2/3rd of Post limb)

Fig: 6

- Corticonuclear track (passes through genu) goes to the cranial nerve nuclei. They act like upper motor neuron for cranial nerves
- Cortico spinal tract passes from anterior 2/3rd of posterior limb

Blood supply to internal capsule 00:45:30

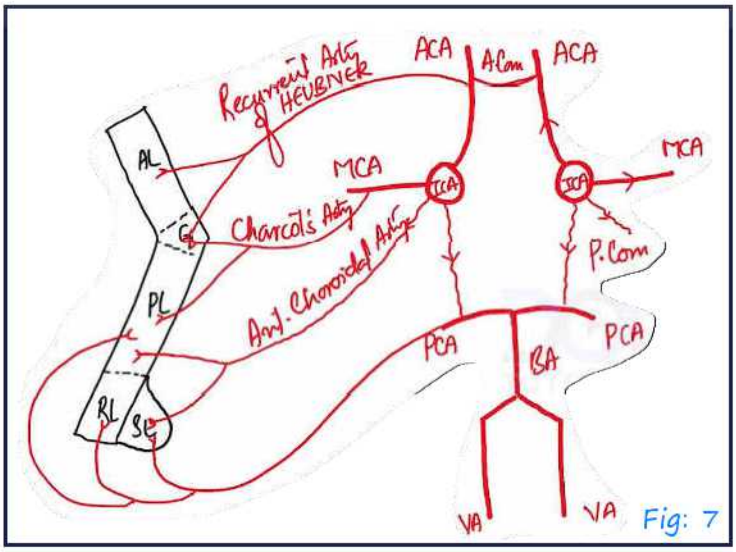

Recurrent Artery of HEUBNER
ACA
ACom
ACA
AL
MCA
ICA
ICA
MCA
G
Charcot's Artery
Ant. Choroidal Artery
P.Com
PL
PCA
PCA
BA
RL
SL
VA
VA

Fig: 7

- PCA – Posterior cerebral A
- BA – Basilar A
- VA – Vertebral A
- ICA – Internal Carotid A
- ACA – Anterior Cerebral A
- Ant. Com – Anterior Communicating A
- Pst. Com – Post Communicating A

- RAH – will supply the anterior limb and genu part
- Charcots artery – will supply genu posterior limb
- Anterior choroidal artery – posterior limb and sub-lentiform part
- PCA – sub-lentiform, retro-lentiform & posterior limb

T.S OF MIDBRAIN, PONS AND MEDULLA

T.S of midbrain 00:00:30

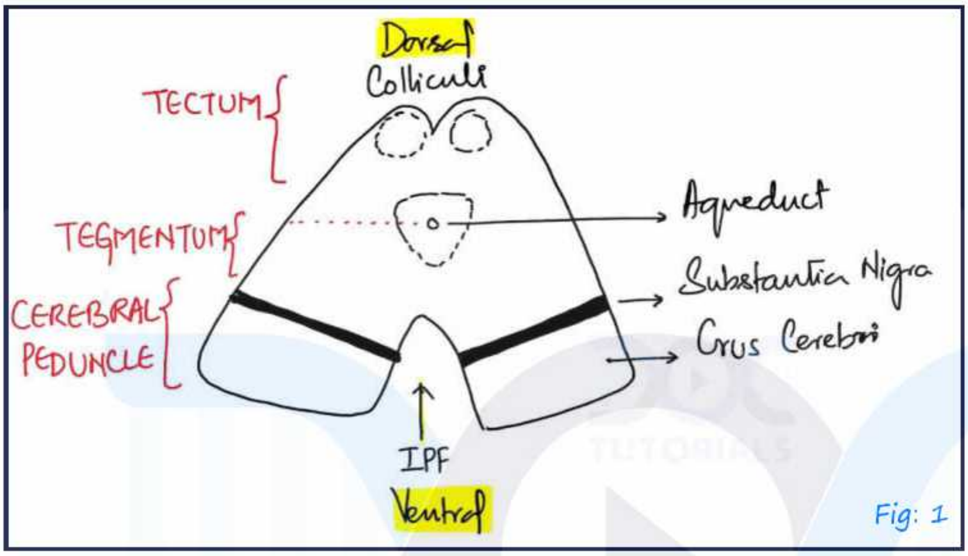

Dorsal
Colliculi
TECTUM
TEGMENTUM
CEREBRAL PEDUNCLE
Aqueduct
Substantia Nigra
Crus Cerebri
IPF
Ventral

Fig: 1

- Aqueduct is present in the center.
- Infront of the brainstem, there is interpedencular fossa (IPF) (ventrally) & behind midbrain (posteriorly), 2 superior colliculi and 2 inferior colliculi.
- Superior & inferior colliculi together are known as corpora quadri gemina.
- Aqueduct is covered by peri-aqueductal grey matter.
- Pyramidal tract will be passing through the crus cerebri – (white matter).
- Area behind aqueduct of sylvius is tectum
- Both the decussation are present in tegmentum.

DOC TUTORIALS LOGIN FOR SUCCESS

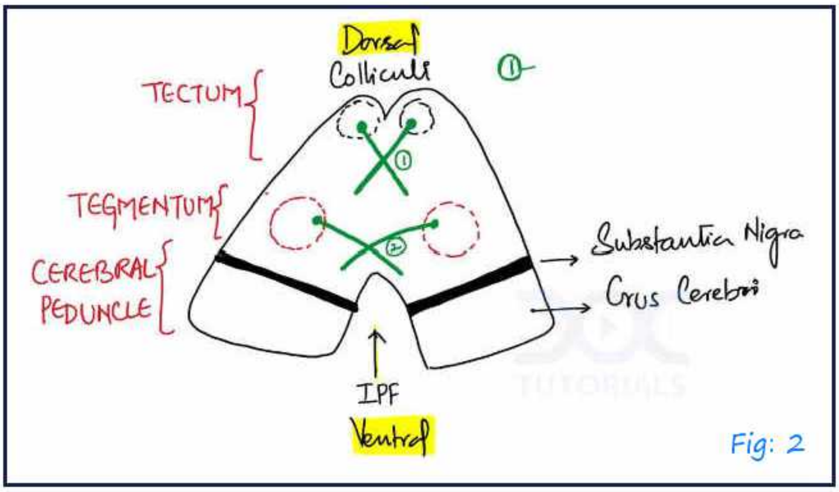

Dorsal
Colliculi
①
TECTUM
TEGMENTUM
CEREBRAL PEDUNCLE
①
②
Substantia Nigra
Crus Cerebri
IPF
Ventral

Fig: 2

- 1st deccusation – dorsal tegmental decussation for tectospinal tract.
- 2nd deccusation – ventral tegmental decussation for rubrospinal tract.

T.S of midbrain at the level of superior colliculus (SC) 00:09:11

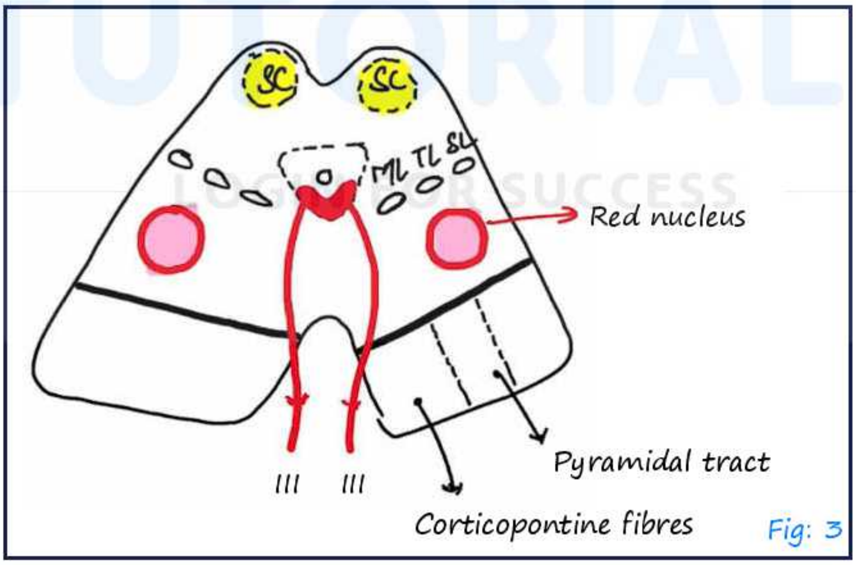

SC
SC
ML
TL
SL
Red nucleus
Pyramidal tract
Corticopontine fibres
III
III

Fig: 3

- At the level of SC – 3rd cranial nerve originates.
- The 3rd cranial nerve has a ventral origin. It passes the IPF & is a content of IPF.

- Red nucleus is seen at the level of SC.

ML – Medial Leminiscus
TL – Trigeminal Leminiscus
SL – Spinal Leminiscus.

T.S of midbrain at the level of Inferior colliculus (SC)

00:15:10

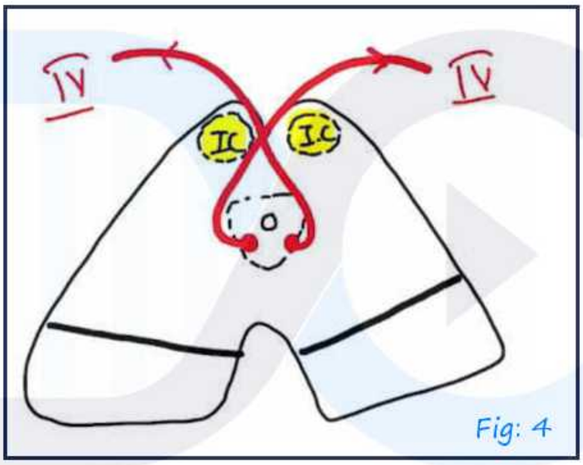


Fig: 4

DOCTUTORIALS
LOGIN FOR SUCCESS

4th cranial nerve

- At the level of IC, the cranial nerve originates from here.
- Cranial nerve 4 nuclei has & separate nuclei.
- It is the only nerve to have dorsal origin. It crosses inside the midbrain and is known as internal decussation.
- It is the thinnest cranial nerve
- It is also the smallest cranial nerve
- It has the longest intra-cranial course.

T.S of PONS 00:18:36

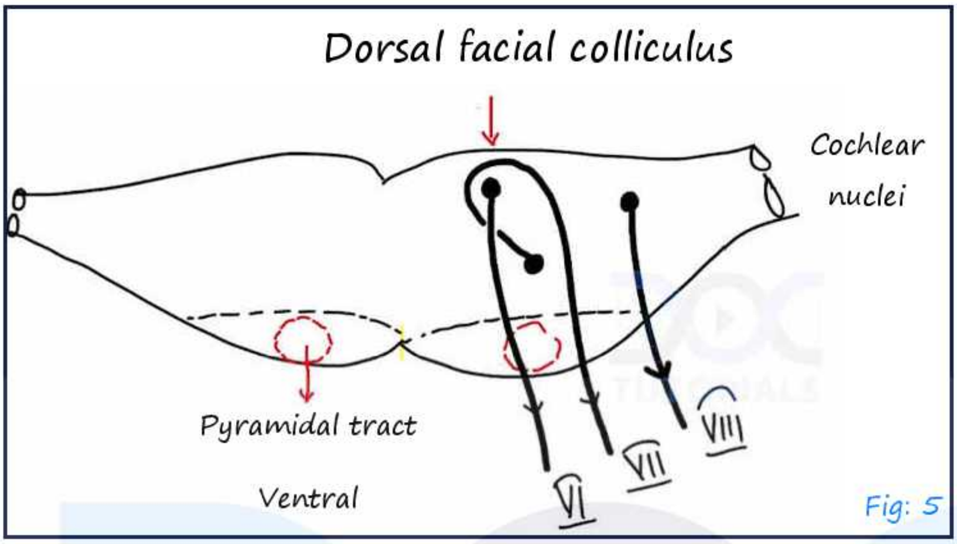

Dorsal facial colliculus
Cochlear nuclei
Pyramidal tract
Ventral
VI
VII
VIII

Fig: 5

- Ventral region of pons – this is the part from where the pyramidal tract are going to descend down.
- The nucleus of 6th cranial nerve is present in pons and the 6th CN is going to exit out from ponto-medullary junction.
- The 7th nerve nucleus is more towards the ventral aspect because of neurobiotaxis.
- The 7th cranial nerve, nerve fibres surround around 6th nucleus & then are going to exit out in gonto-medullary junction.
- Elevation on the dorsal surface is facial colliculus caused due to 6th CN nucleus & 7th CN fibres.
- The 8th cranial nerve will exit from ponto-medullary junction.

DOC TUTORIALS LOGIN FOR SUCCESS

T.S of Medulla 00:24:00

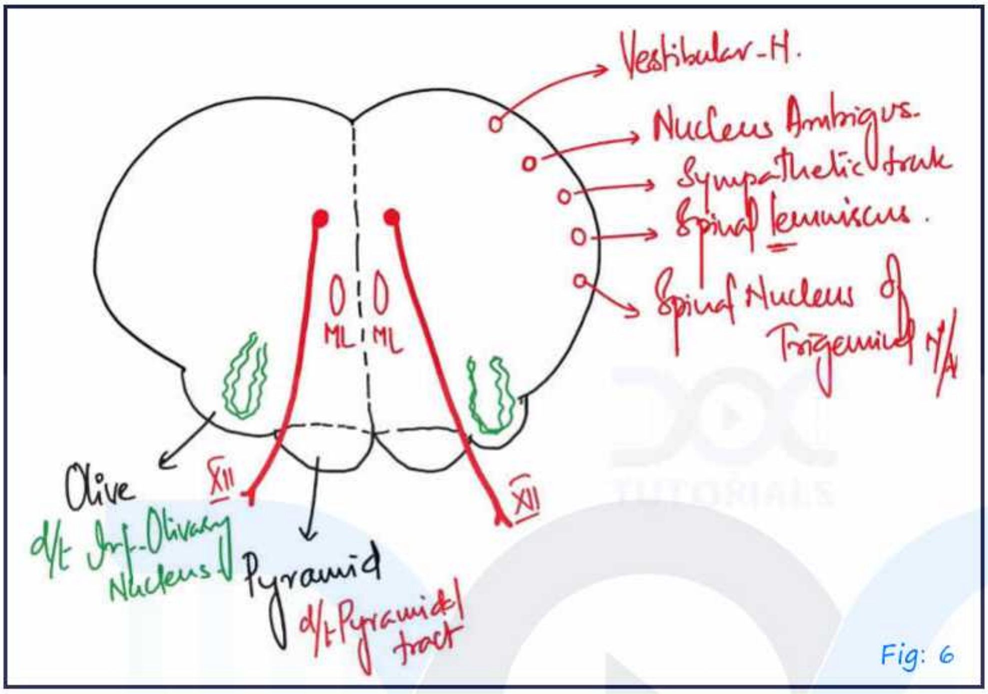

Vestibular-N.
Nucleus Ambigus.
Sympathetic tract
Spinal lemniscus.
Spinal Nucleus of Trigeminal N/V
ML
ML
XII
XII
Olive
d/t Inf-Olivary Nucleus
Pyramid
d/t Pyramidal tract

Fig: 6

- Pyramid name is given due to the presence of pyramidal tract
- Olive name was given due to the presence of inferior olivary nucleus.
- Cranial nerve originating from medullary oblangata are 9, 10, 11 & 12
- 12th nerve comes out b/w pyramid & olive.
- 9, 10, 11th cranial nerves comes out lateral to olive.
- 9, 10, 11th CNs have a common nucleus known as nucleus ambigus.
- In the medial medullary syndrome, the 12th nerve is involved along with medial leminiscus (ML) & in lateral medullary syndrome, all the lateral structures will be involved.

CEREBELLUM

Cerebellum 00:00:10

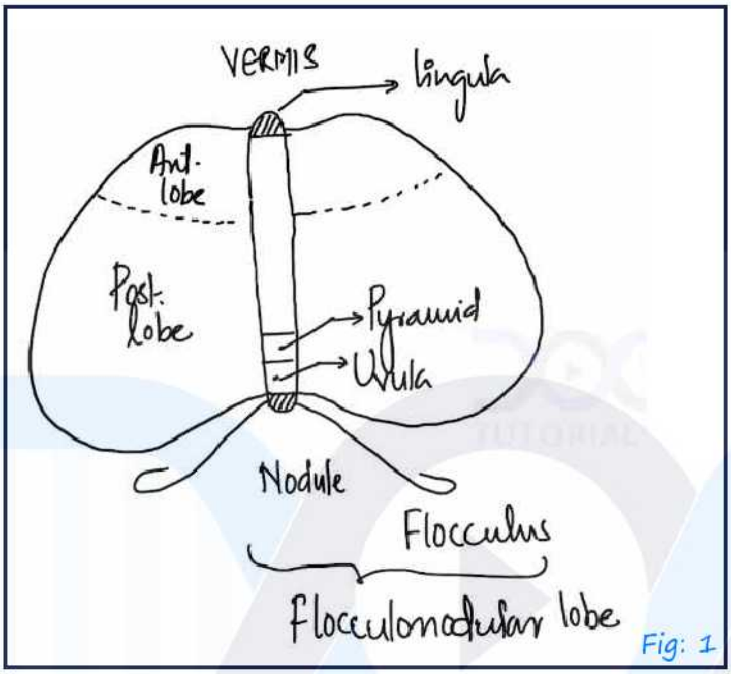

VERMIS
lingula
Ant. lobe
Post. lobe
Pyramid
Uvula
Nodule
Flocculus
Flocculonodular lobe

Fig: 1

- Flocculus along with nodule is known as flocculonodular lobe.

Classification of Cerebellum 00:03:02

Archa cerebellum (or) Vestibular cerebellum	Paleocerebellum (or) Spinal cerebellum	Neocerebellum (or) Cerebral cerebellum
It includes Ligula Flocculonodular lobe	It includes Anterior lobe Pyramid Uvula	It includes Posterior lobe Pyramid & uvula

- Midbrain is joining the cerebellum with the help of superior cerebellum peduncle
- Pons is joining the cerebellum with the help of middle cerebellum peduncle
- Medulla obligate is joining the cerebellum with the help of inferior cerebellum peduncle

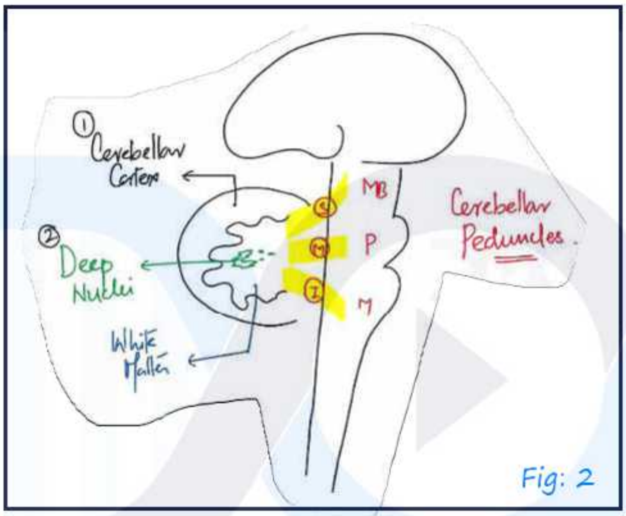

① Cerebellar Cortex
② Deep Nuclei
White Matter
S
M
I
MB
P
M
Cerebellar Peduncles.

Fig: 2

Cerebellar cortex

- It is arranged in 3layers & those 3layers have 5 types of cells
- The outer most layer is known as molecular layer. They have stellate cells & basket cells
- The middle layer is known as Purkinje layer. They have Purkinje cells
- The inner layer is known as granular layer. They have granular cell & golgi cells

TUTORIALS LOGIN FOR SUCCESS

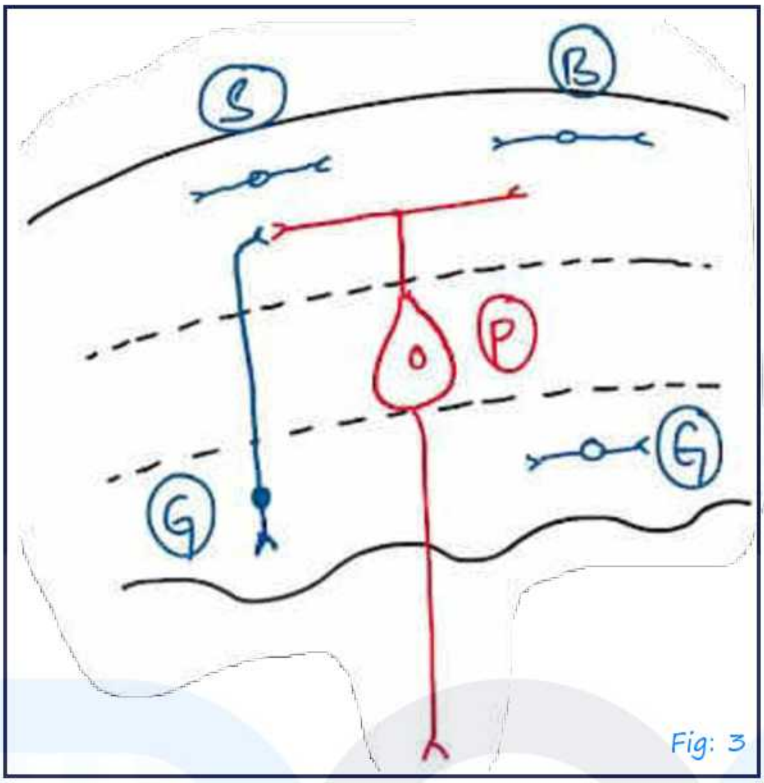


Fig: 3

- Purkinje cells are the largest out of 5 they are flak shaped
- Granular cells – They climb up & form synapse with Purkinje cells
- All these cells are inhibitory except granular cells. Granular cells are the only excitatory cells
- Efferent from cerebellum is deep nuclear

AfraTafreen.com
DOC TUTORIALS
LOGIN FOR SUCCESS

White matter 00:18:25

Afferents of cerebellum 00:18:25

They are of 2 types

1.Mossy fibres

- They only reach the granular layer & forms synapses with granular cells
- These granular cells carry the information till molecular layer and form synapses with Purkinje cells

2.Climbing fibres

- They climb all the way to granular Purkinje layer & then reach to the molecular layer & they synphase with the Purkinje cells
  - Eg: Olivo – Cerebellar track
  - Para – Oliva cerebellar tract
- The synapse formed between the mossy fibres and granular cells is known as cerebellar glomeruli

---

Deep nuclei 00:22:50

- There are 4 deep nuclei in cerebelli (mnemonic – Doctors Eat Good Food)

  D- dentate nucleus

  E- emboliform nucleus

  G- Globus

  F- fastigial nucleus

- Dentate is
  - Largest nucleus
  - Lateral most nucleus
  - Crumpled paper bag shape
  - It is the only nucleus of neocerebellum
- Fastigeal nucleus
  - Medial most nucleus
  - This also belongs to archae cerebellum
- Globus nucleus } Together are known as
- Emboliform nucleus } Interpositus nucleus
- Fastigeal, globus & emboliform nucleus of paleocerebellum

TUTORIALS LOGIN FOR SUCCESS

Tracts passing through cerebellar peduncle

- Super cerebellar peduncle

Afferent	Efferent
Ventral spibnocerebellar tract Tectocerebellar tract	Dentatothalamic tract Dentatorubral tract Cerebello olivary tract Cerebello reticular tract

- Middle cerebellar peduncle (MCP)

Afferent	Efferent
– Corticoponto cerebellar tract – Reticular cerebellar tract	– MCP is purely afferent – It is the largest

THORACIC WALL AND INTERCOSTAL SPACE

Thoracic wall 00:01:11

- Anteriorly – sternum – 3 parts
- Posteriorly – thoracic vertebrae – 12
- Laterally – ribs

Fracture sternum – 3 parts

1. Manubrium
2. Body of sternum
3. Xiphoid process

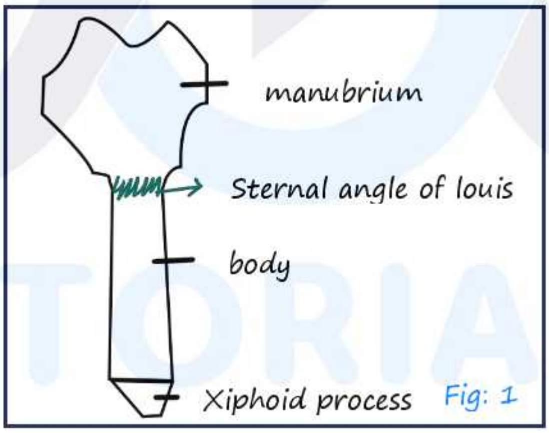

manubrium
Sternal angle of louis
body
Xiphoid process

Fig: 1

- Between the manubrium and the body, there is a joint → sternal angle of Louis

↓

Second rib (costal cartilage) joins here

Fracture Ribs 00:03:41

Ribs (12 pairs)

- True (1-7)
  - Attached to sternum
  - Vertebra-sternal ribs
- False (8-12)
  - 8,9,10
    - Vertebra-chondral
  - 11,12
    - Floating ribs

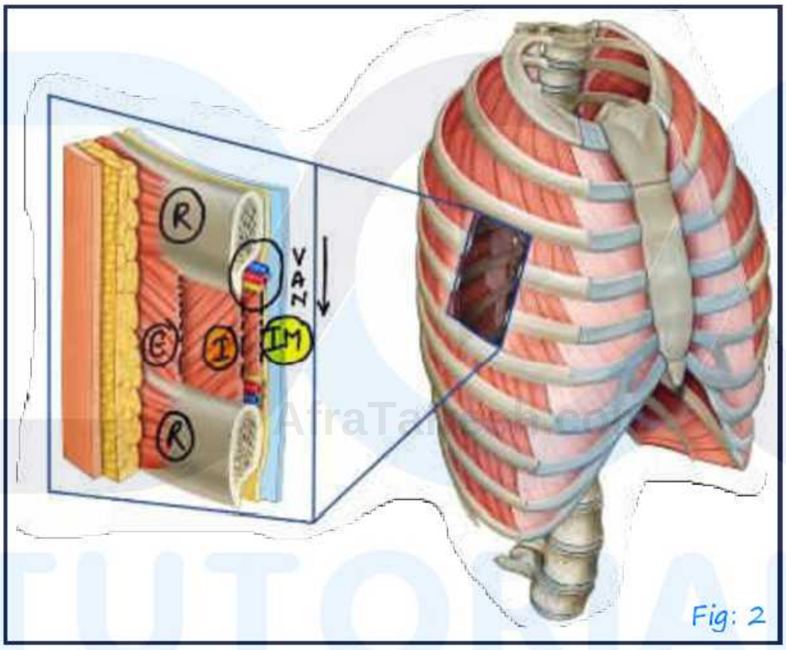


Fig: 2

DOC TUTORIALS
LOGIN FOR SUCCESS
AfraTasneem

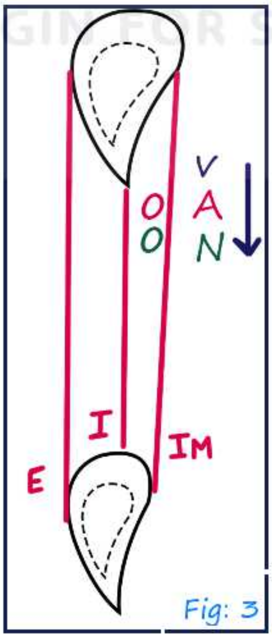


Fig: 3

Clinical application 00:18:01

- In pleural tap, needle should be inserted above the lower rib
  - Done along mid-axillary line
  - 7th, 8th, 9th Inter costal spaces

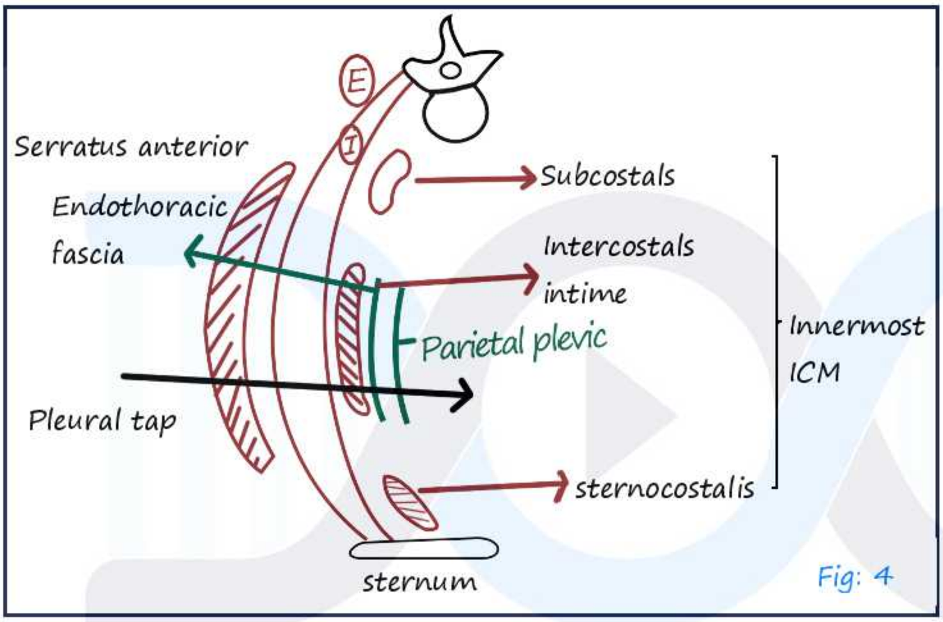

E
I
Serratus anterior
Endothoracic fascia
Subcostals
Intercostals intime
Parietal plevic
Innermost ICM
Pleural tap
sternocostalis
sternum

Fig: 4

- In pleural tap, muscles crossed are:
  - Serratus anterior
  - External ICM
  - Internal ICM
  - Intercostalis intimi
  - Endothoracic fascia
  - Parietal pleura.

INTERCOSTAL ARTERY

Intercostal artery 00:00:45

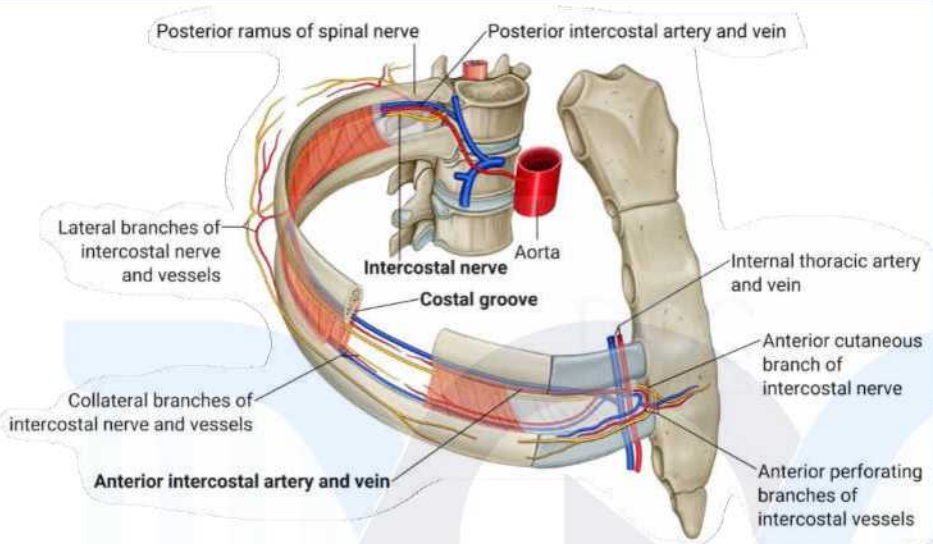

Posterior ramus of spinal nerve
Posterior intercostal artery and vein
Lateral branches of intercostal nerve and vessels
Intercostal nerve
Aorta
Costal groove
Internal thoracic artery and vein
Anterior cutaneous branch of intercostal nerve
Collateral branches of intercostal nerve and vessels
Anterior intercostal artery and vein
Anterior perforating branches of intercostal vessels

Fig: 1

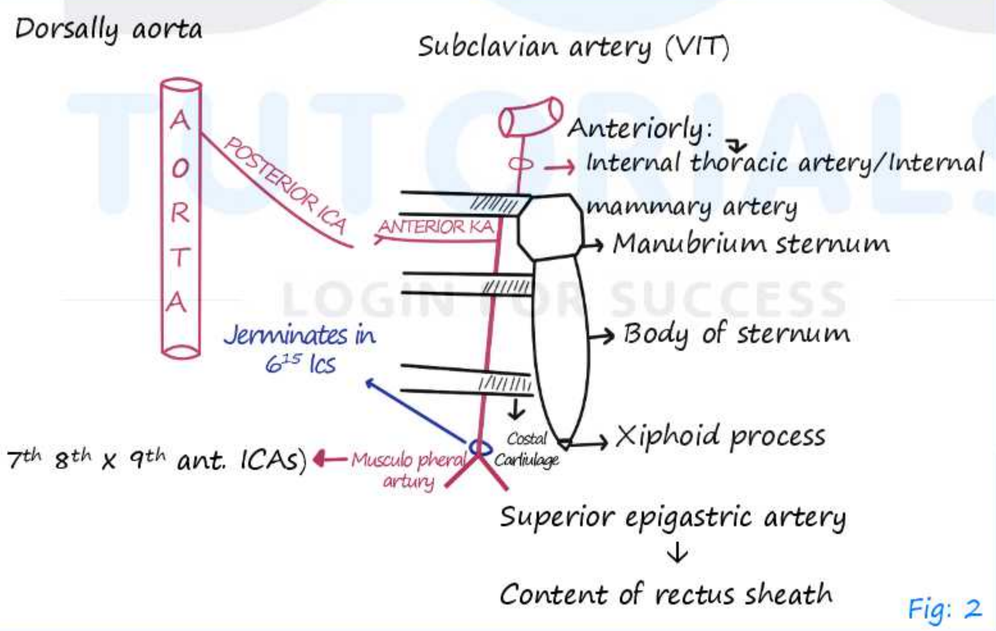

Dorsally aorta
Subclavian artery (VIT)
AORTA
POSTERIOR ICA
ANTERIOR KA
Anteriorly:
Internal thoracic artery/Internal mammary artery
Manubrium sternum
Body of sternum
Jerminates in 6 15 Ics
Costal Carliulage
Xiphoid process
7th 8th x 9th ant. ICAs)
Musculo pheral artury
Superior epigastric artery
Content of rectus sheath

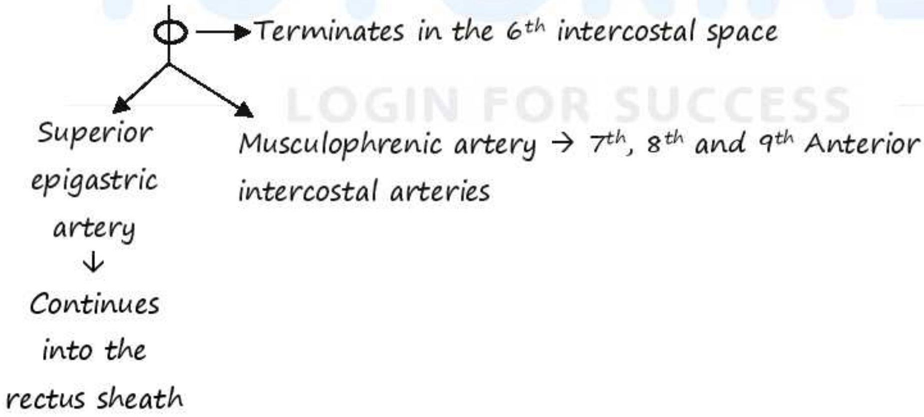
Fig: 2

Posterior intercostal artery 00:07:13

- 12 pairs of ribs → 11 intercostal spaces on each side → 11 pairs of posterior intercostal arteries
- Superior intercostal artery → gives the upper 2 pairs of posteriors (subclavian A → costo-cervical trunk → superior ICA) ICAs
- Remaining 9 pairs → given by Aorta (lower 9)

Anterior intercostal artery 00:09:49

- Anteriorly 10 ribs (10 pairs) → 9 intercostal spaces (9 pairs) → 9 pairs of anterior intercostal arteries
- 10th and 11th intercostal space will not have anterior intercostal arteries
- Internal thoracic artery → upper 6 pairs of anterior intercostal arteries


Terminates in the 6th intercostal space
Superior epigastric artery
↓
Continues into the rectus sheath
Musculophrenic artery → 7th, 8th and 9th Anterior intercostal arteries

Intercostal artery

Posterior intercostal arteries
11 pairs

- Superior ICA → upper 2 pairs
- Aorta → Lower 9 pairs

Anterior intercostal arteries
9pairs

- Internal thoracic artery → upper 6 anterior ICA's
- Musculophrenic artery → 7th, 8th and 9th anterior ICA

- The internal thoracic artery terminates in the 6th intercostal space.

INTERCOSTAL VEIN AND INTERCOSTAL NERVE

Branches of internal thoracic artery 00:00:21

- Anterior ICA
- Posterior ICA

1.Anterior intercostal arteries (upper 6)
2.Superior epigastric artery
3.Musculophrenic artery
Terminal branches
4.Mediastinal branches → Thymus gland
5.Pericardiophrenic branch
6.Perforating branches → Mammary gland in Females

Intercostal vein 00:03:12

- Anterior ICV
- Posterior ICV

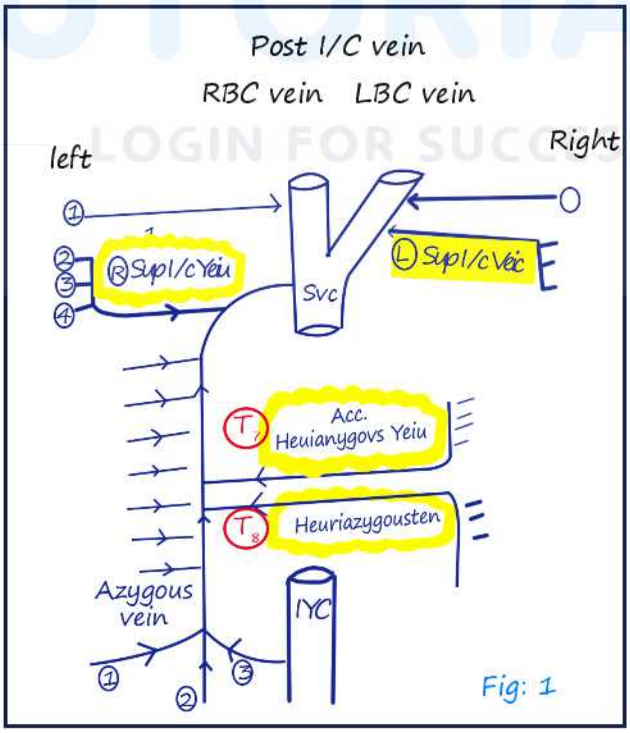

Post I/C vein
RBC vein
LBC vein
left
Right
①
②
③
④
Ⓡ Supl/c Yeiu
Ⓛ Supl/c Veic
Svc
T7
Acc. Heuianygovs Yeiu
T8
Heuriazygousten
Azygous vein
IYC
①
②
③

Fig: 1

- Right superior intercostal vein → Azygous vein
- Left superior intercostal vein → Left brachiocephalic vein
- Right superior ICV, accessory hemiazygous vein, hemiazygous vein **except the left superior ICV** → drain into the azygous vein

Azygous vein 00:14:26

- Formation
  - Rt subcostal vein
  - Ascending lumbar vein
  - Lumbar azygous vein

Intercostal nerve 00:17:09

- T_1 → Branchial plexus
- T_2 → Intercosto brachial artery
- T_3, T_4, T_5, T_6 → typical ICN (Supplies only to intercostal space)
- T_7, T_8, T_9, T_{10}, T_{11} → Anterior abdominal wall (contents of rectus sheath)
- T_{12} → Subcostal nerve
  - Typical → supplies only to intercostal space and nothing else

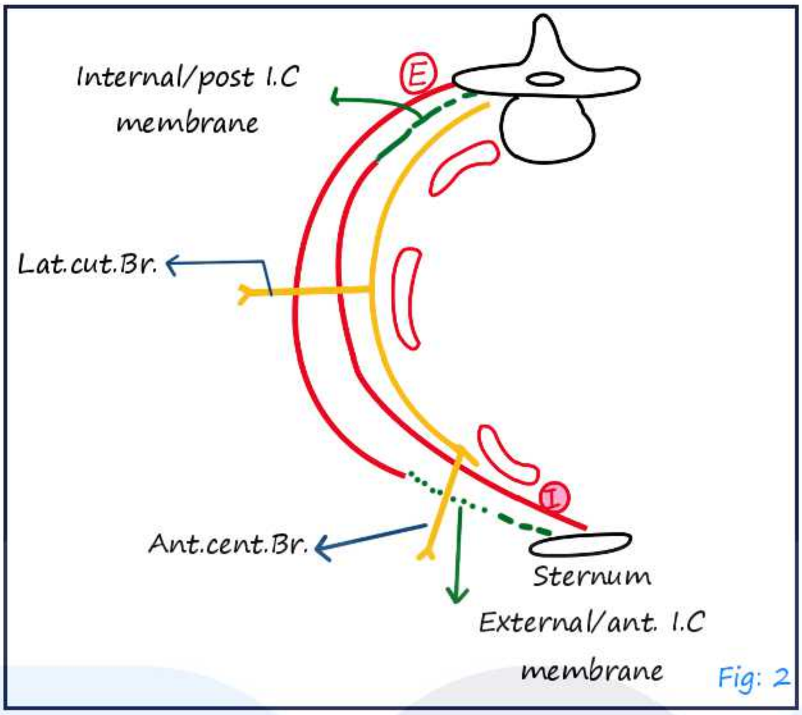

Internal/post I.C membrane
E
Lat.cut.Br.
I
Ant.cent.Br.
Sternum
External/ant. I.C membrane

Fig: 2

- Lateral cutaneous branch: - Pierces
  - Exterior intercostal muscle
  - Interior intercostal muscle

- Anterior cutaneous branch: - Pierces
  - Internal IC muscle
  - Exterior IC membrane

DOC TUTORIALS LOGIN FOR SUCCESS

POSITION OF HEART AND PERICARDIUM

Pericardium 00:00:25

Pericardium
- Fibrous pericardium (outer)
- Serous pericardium (Inner)
  - Parietal (outer)
  - VISCERAL (inner)

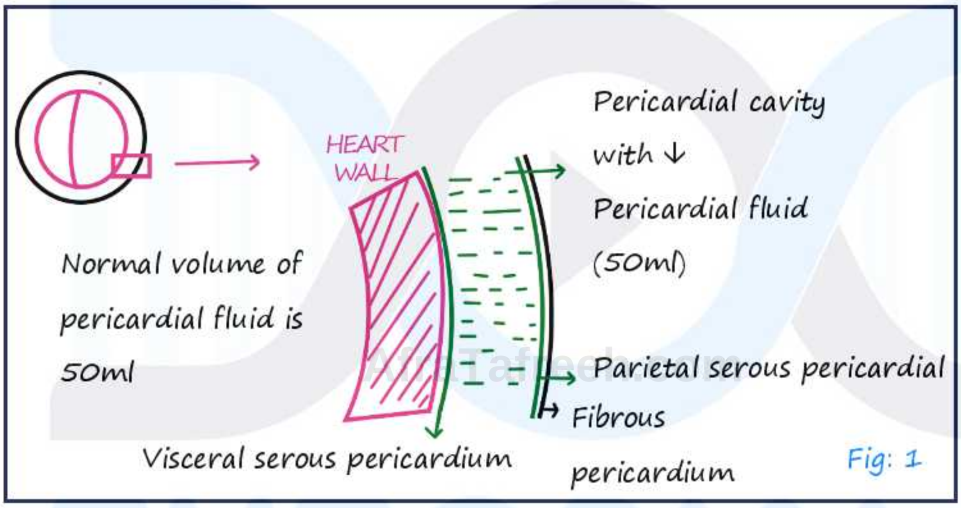

HEART WALL
Pericardial cavity with ↓ Pericardial fluid (50ml)
Normal volume of pericardial fluid is 50ml
Parietal serous pericardial
Fibrous pericardium
Visceral serous pericardium

Fig: 1

Sinuses of Pericardium 00:06:48

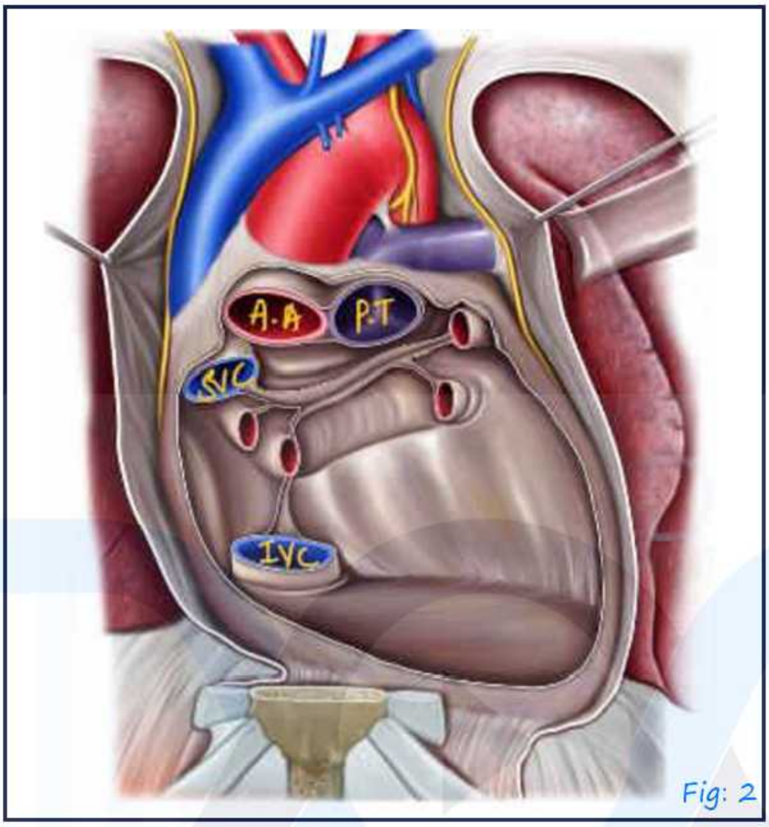
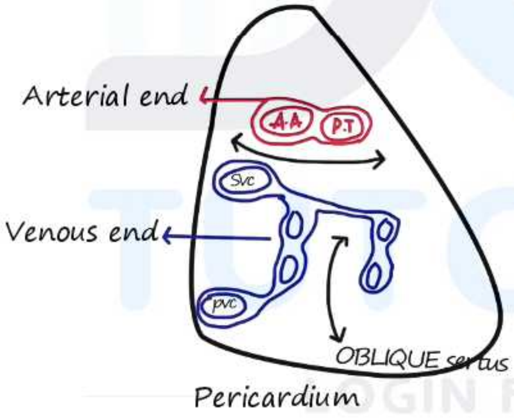

A.A
P.T
SVC
IVC

Fig: 2


Arterial end
A.A
P.T
Svc
Venous end
pvc
OBLIQUE sinus

Pericardium

(Without the heart)

Transverse sinus:

- Between the arterial end & venous end
- Anteriorly: Ascending aorta (AA) & pulmonary trunk (PT)
- Posteriorly: SVC and pulmonary veins (PVs)

Oblique sinus

- Two pulmonary veins from each lung open into the LEFT ATIRUM
- It is just behind the left atrium.
  - Anteriorly: left atrium
  - Posteriorly: Oesophagus

- Oblique sinus is the dead space for enlargement of left atrium whenever there is increased venous return. [This sinus prevents the compression of esophagus during increased venous return]

Sinuses of pericardium

Transverse sinus:	**Oblique sinus**
- Between arterial end and venous end.	- Between pulmonary veins
- Anteriorly: AA and PT	- Anteriorly: left atrium
- Posteriorly: SVC and PVs	- Posteriorly: Oesophagus

Heart 00:15:59

TUTORIALS GOING FOR SUCCESS

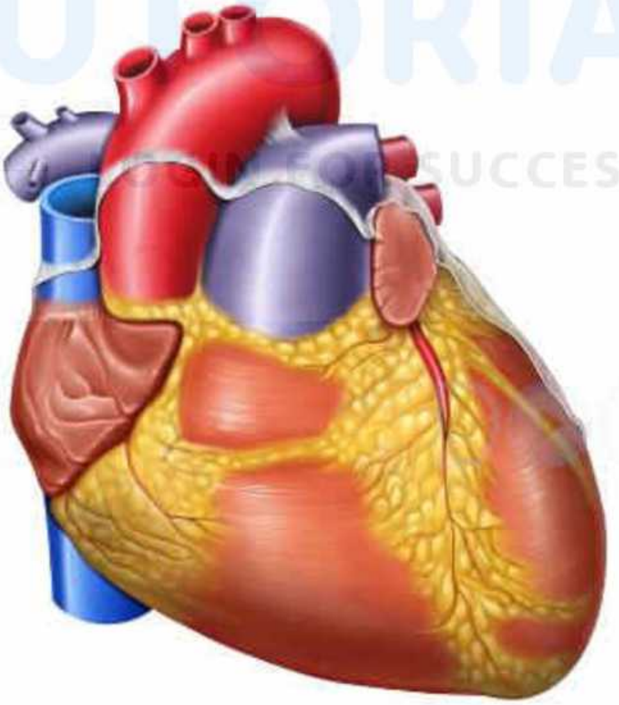
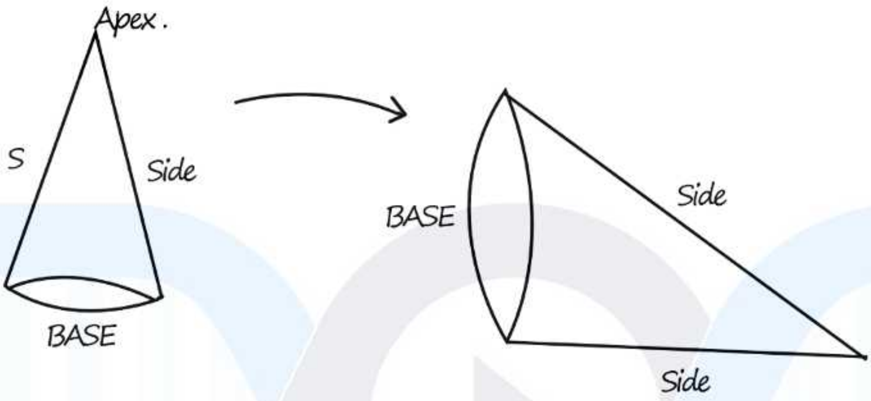


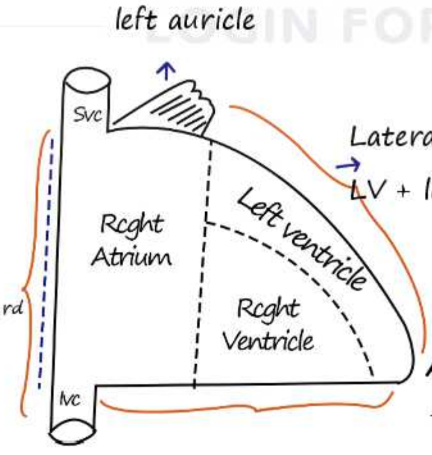
Fig: 3

- Shape: Cone-shaped
- Size: size of a closed fist.
  - Heart is present inside the body as a cone that has fallen on one of its side.


Apex.
S
Side
BASE
BASE
Side
Side

- Right border – only right atrium
- Right cardiac shadow (SIR):
  - SVC
  - IVC
  - RA

DOC TUTORIALS
LOGIN FOR SUCCESS


left auricle
Svc
Rcght Atrium
Left ventricle
Rcght Ventricle
Ivc

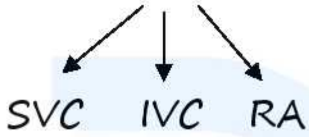
Lateral surface: – LV + left auricle

Base: – RA+LA 1/3rd 2/3rd

→RA+RV+LV

Apex: formed by left ventricle
- Apex is located in the left 5th intercostal space (5th ICS)
- 9cms away from sternum

- Apex: Left ventricle
- Base: Right atrium (1/3) + Left atrium (2/3)
- Inferior surface: Right atrium + Right Ventricle + left ventricle
- Lateral surface: Left ventricle + Left auricle
- Right border: Only right atrium
- Right cardiac shadow (SIR)



CORONARY CIRCULATION AND VENOUS DRIANAGE OF HEART

Course and Branches 00:00:07

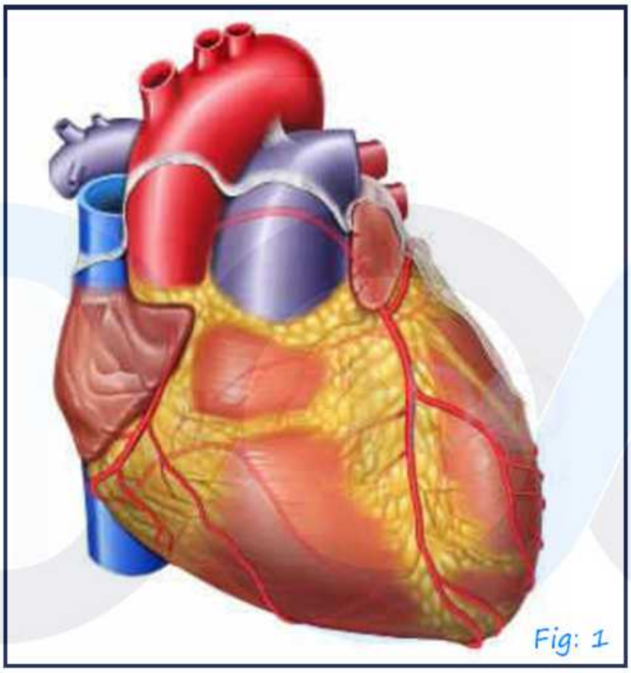


Fig: 1

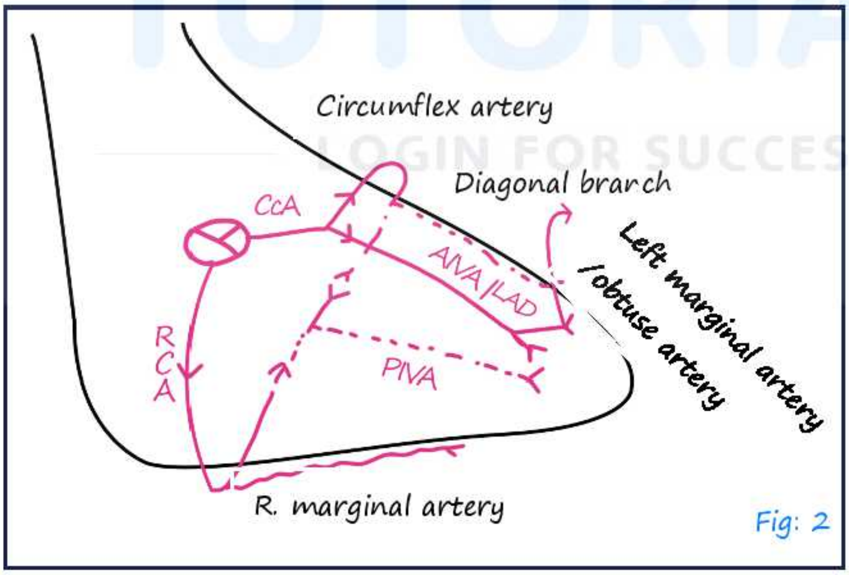

Circumflex artery
Diagonal branch
CcA
AIVA/LAD
Left marginal artery
/obtuse artery
RCA
PIVA
R. marginal artery

Fig: 2

- Right Coronary Artery – 2 branches
  - Gives a branch → posterior intraventricular artery

  - Gives another branch → Right marginal artery/Acute marginal artery
- Left coronary artery – 2 branches
  - Circumflex artery
  - Anterior interventricular artery/LAD artery (left anterior descending artery)
- Circumflex artery → gives a branch → left marginal artery or obtuse artery
- Diagonal branch (branch of anterior interventricular/LAD artery) → supplies to the LEFT VENTRICLE

Blood Supply of the Heart – Coronary Circulation

00:01:14

- Coronary Arteries
  - Right coronary artery (Ant. Aortic Sinus)
  - Left coronary artery (left post. aortic sinus)

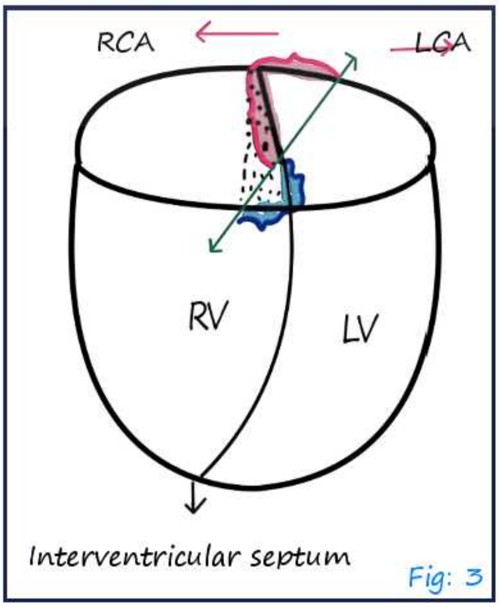


Fig: 3

- RCA: -
  - RA
  - RV
  - Posterior part of left ventricle
  - Posterior part of interventricular septum
- LCA: -
  - LA
  - LV
  - Anterior part of RV
  - Anterior part of interventricular septum

Origin

Aortic Sinuses

- Anterior - 1
  - Aortic sinus ↓ Right coronary artery
- Posterior - 2
  - Right post aortic sinus
  - left post aortic sinus ↓ Left coronary artery

DOC TUTORIALS
LOGIN FOR SUCCESS

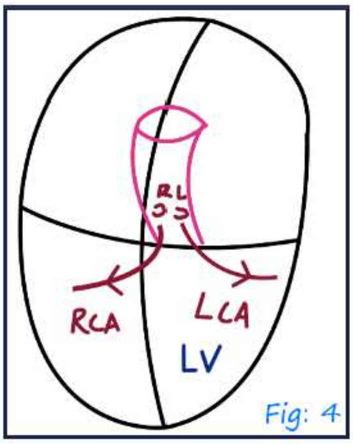


Fig: 4

- Right coronary artery:
  - Begins from Anterior aortic sinus
- Left coronary artery:
  - Begins from left posterior aortic sinus
- Coronary arteries begin exactly at the beginning of the ascending aorta.

Conduction System of Heart 00:19:16

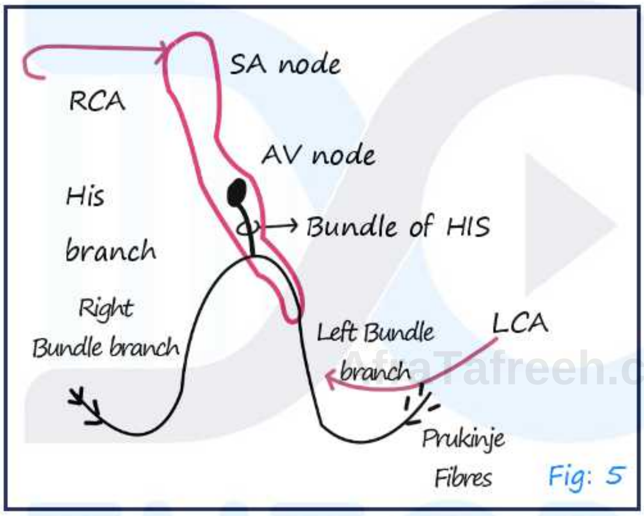

SA node
RCA
AV node
His
branch
Bundle of HIS
Right
Bundle branch
Left Bundle
branch
LCA
Prukinje
Fibres

Fig: 5

- RCA
  - SA Node
  - AV Node
  - Bundle of his
  - Left bundle branch (minor)
- LCA
  - Left bundle branch (major)
  - Right bundle branch
- Heart is mainly supplies by the left coronary artery

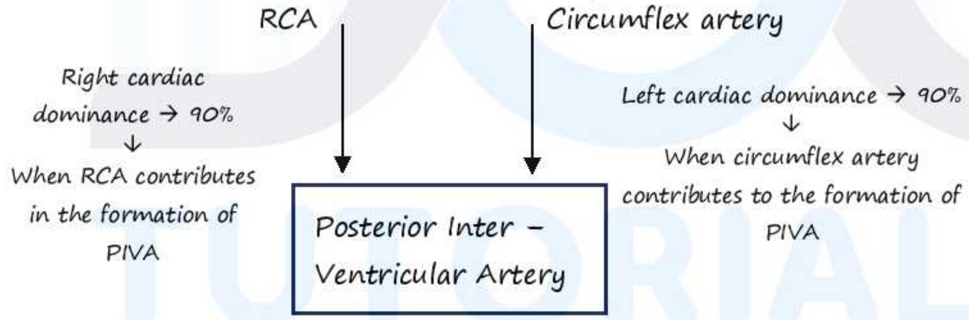
SA Node (Sinoatrial Node) 00:22:18

- Supplied by nodal branch given by RCA in 65% people
  - RCA → Nodal branch → SA node
- Remaining 35% population
  - LCA → Nodal branch → SA node

- 65% → RCA
- 35% → LCA

Nodal branch → SA node

Cardiac Dominance 00:26:06



Right cardiac dominance → 90%
↓
When RCA contributes in the formation of PIVA

Left cardiac dominance → 90%
↓
When circumflex artery contributes to the formation of PIVA

Combined Cardiac dominance/co-dominance → 1%
↓
When both RCA and circumflex arteries contribute to the formation of PIVA.

Venous Drainage of the Heart 00:29:54

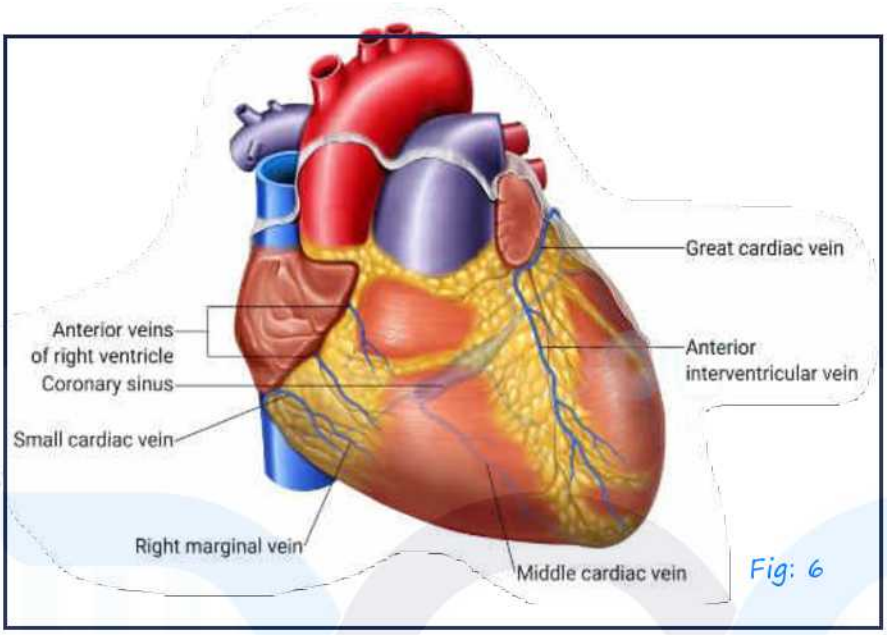

Great cardiac vein
Anterior veins of right ventricle
Coronary sinus
Anterior interventricular vein
Small cardiac vein
Right marginal vein
Middle cardiac vein

Fig: 6

1. Coronary sinus
   - Location: posterior atrioventricular groove/posterior coronary sulcus.
   - Length: 3cms
2. Cardiac veins $\xrightarrow{\text{drain into}}$ Coronary sinus $\xrightarrow{\text{drains into}}$ RIGHT ATRIUM
   - Great cardiac vein
   - Small Cardiac vein
   - Middle cardiac vein
3. Anterior Cardiac Veins (3-4) → directly drain the blood into the right atrium (without draining into coronary sinus)

4. Oblique vein of LA/Marshall's vein $\xrightarrow{\text{drains blood into}}$ coronary sinus

5. Posterior vein of left ventricle $\xrightarrow{\text{drains into}}$ coronary sinus.

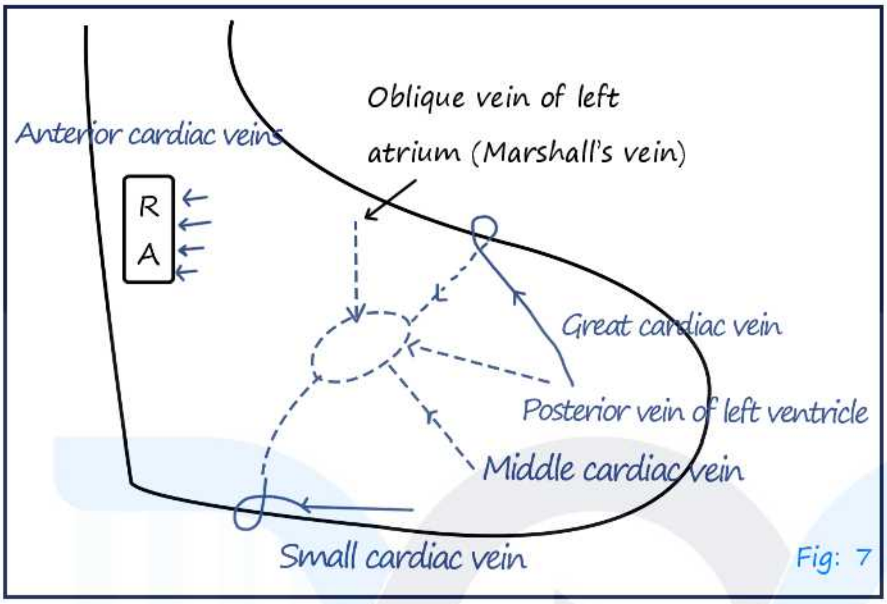

Anterior cardiac veins
R
A
Oblique vein of left
atrium (Marshall's vein)
Great cardiac vein
Posterior vein of left ventricle
Middle cardiac vein
Small cardiac vein

Fig: 7

RIGHT ATRIUM AND RIGHT VENTRICLE

Internal Features of Right Atrium 00:00:10

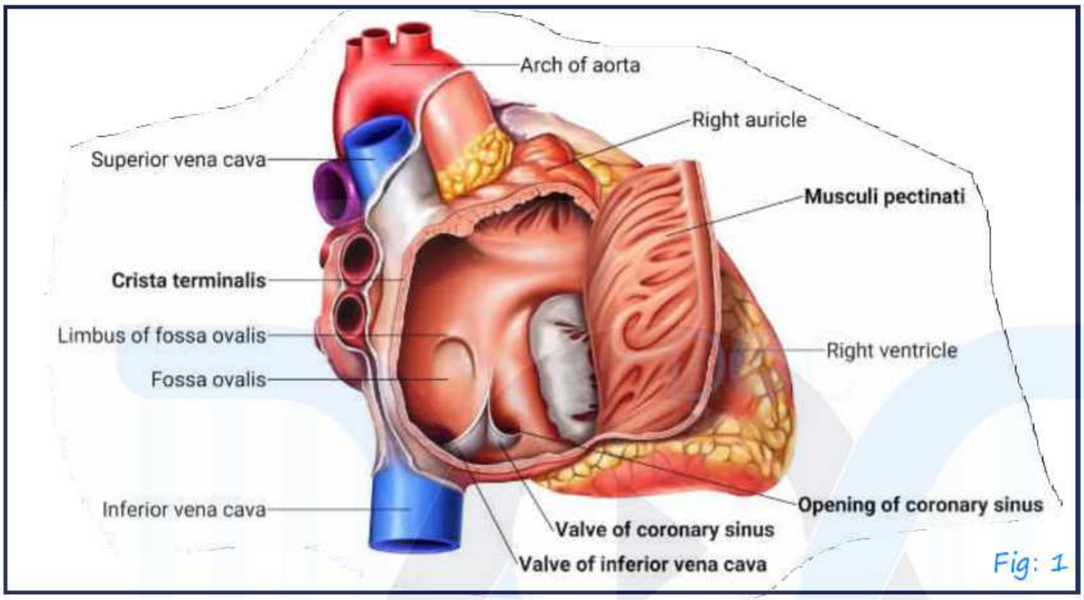

Arch of aorta
Right auricle
Superior vena cava
Musculi pectinati
Crista terminalis
Limbus of fossa ovalis
Right ventricle
Fossa ovalis
Opening of coronary sinus
Inferior vena cava
Valve of coronary sinus
Valve of inferior vena cava

Fig: 1

- F.O – Fossa Ovalis
- L – Limbus/Margin of Fossa Ovalis

DOC TUTORIALS
LOGIN FOR SUCCESS

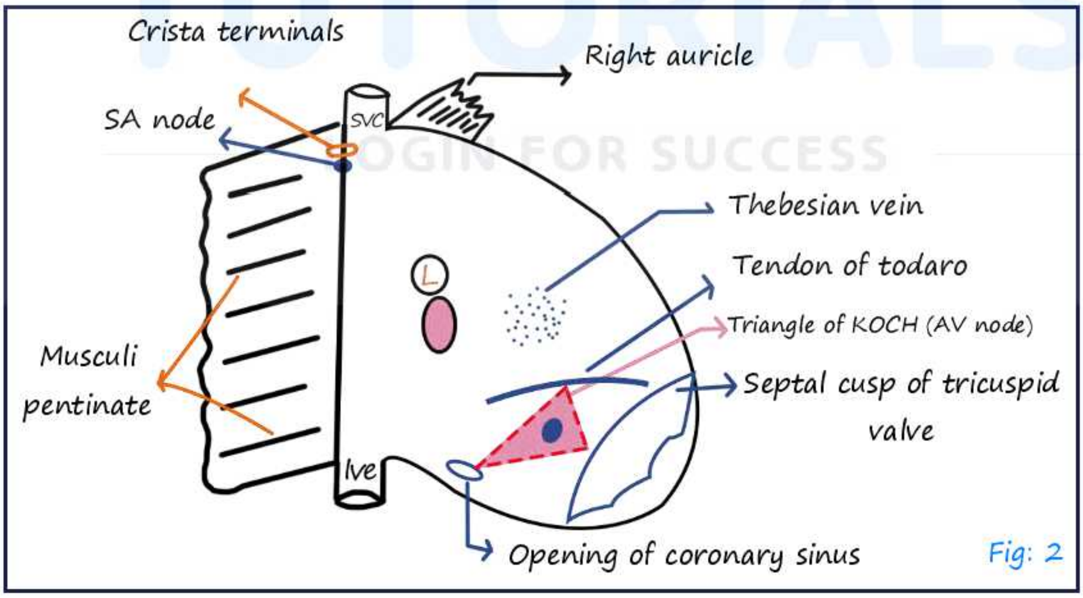

Crista terminals
Right auricle
SA node
SVC
Thebesian vein
Tendon of todaro
L
Triangle of KOCH (AV node)
Musculi
pentinate
Septal cusp of tricuspid
valve
Ive
Opening of coronary sinus

Fig: 2

- Crista terminalis: Muscular ridge between SVC and IVC

  - Upper part of crista terminalis has SA node
  - Separates the rough part from the smooth part.
- Musculi pectinate – Anterior wall is rough with muscles present like teeth of the comb called musculi pectinate
- Fossa ovalis – present on the INTER-ATRIAL septum
  - Above fossa ovalis, a margin known as LIMBUS/MARGIN of fossa ovalis is present.
- Septal cusp of tricuspid valve: present in between RA & RV
- **Triangle of KOCH:** location for AV node
  - Formed by the (**Boundaries**): 1. Tendon of Todaro
    2. Opening of coronary sinus and
    3. Septal cusp of tricuspid valve.
- Thebesian veins: small veins opening directly into the RA found on the posterior wall.

Internal Structures of Right Ventricle 00:12:15

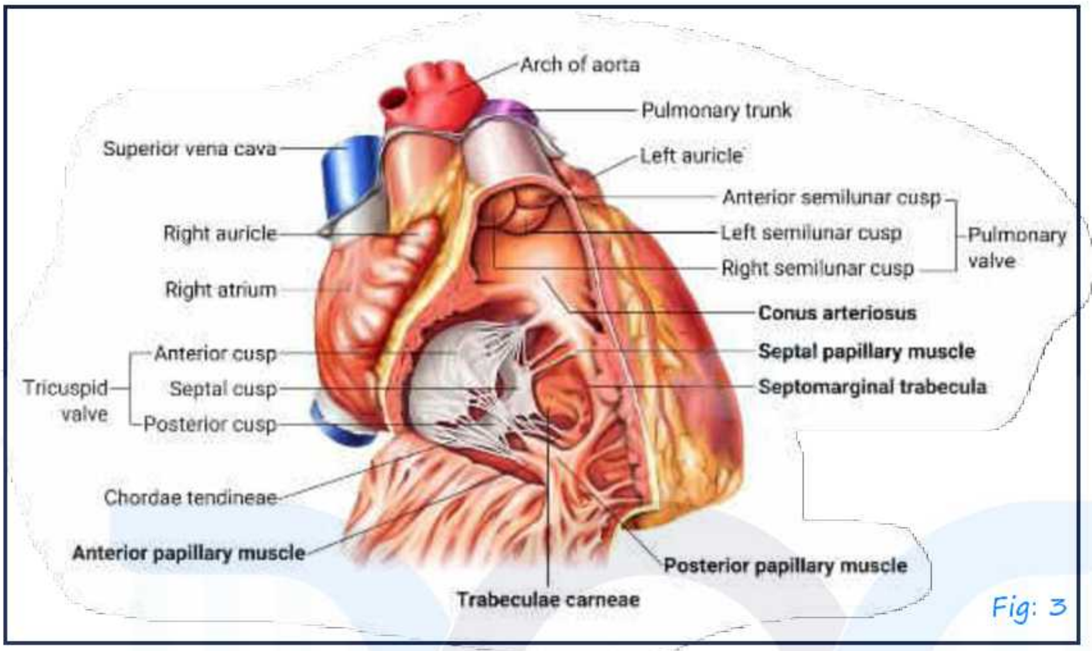

Arch of aorta
Pulmonary trunk
Superior vena cava
Left auricle
Anterior semilunar cusp
Left semilunar cusp
Right semilunar cusp
Pulmonary valve
Right auricle
Right atrium
Conus arteriosus
Septal papillary muscle
Septomarginal trabecula
Tricuspid valve
Anterior cusp
Septal cusp
Posterior cusp
Chordae tendineae
Anterior papillary muscle
Posterior papillary muscle
Trabeculae carneae

Fig: 3

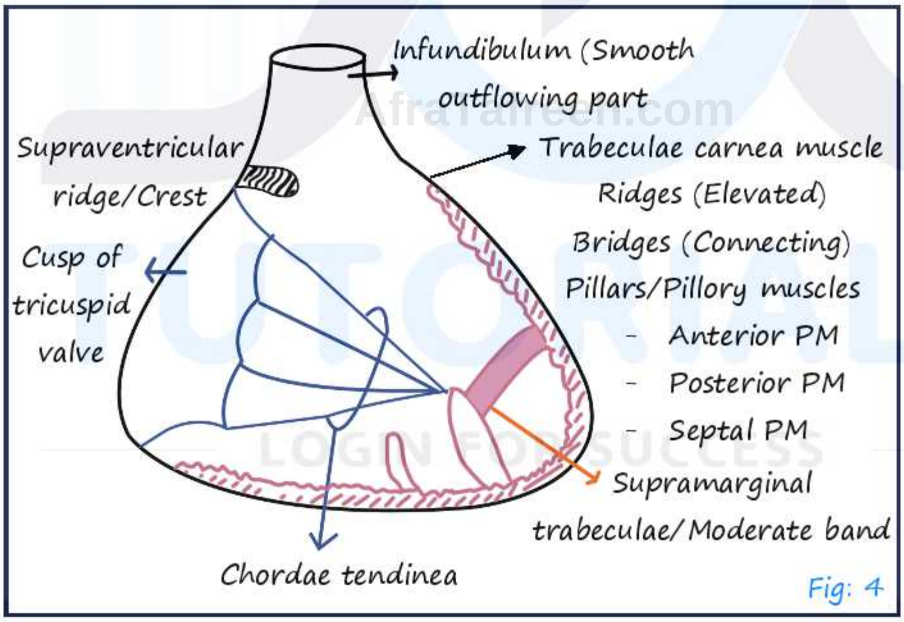
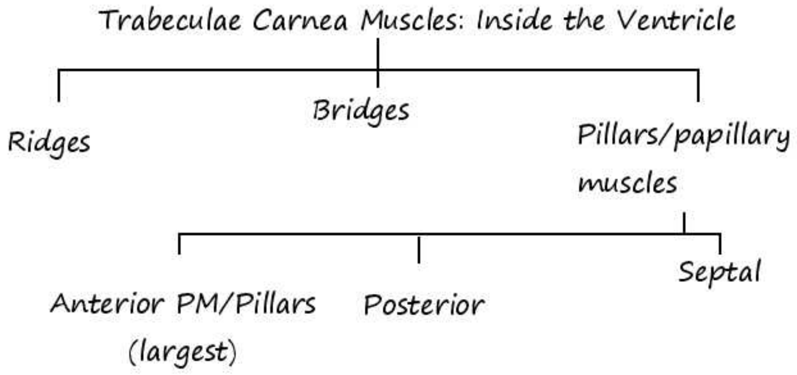

Infundibulum (Smooth outflowing part
Supraventricular ridge/Crest
Trabeculae carnea muscle
Ridges (Elevated)
Bridges (Connecting)
Pillars/Pillory muscles
- Anterior PM
- Posterior PM
- Septal PM
Cusp of tricuspid valve
Supramarginal trabeculae/Moderate band
Chordae tendinea

Fig: 4


Trabeculae Carnea Muscles: Inside the Ventricle
Ridges
Bridges
Pillars/papillary muscles
Anterior PM/Pillars (largest)
Posterior
Septal

- The tip of the Papillary muscle is connected to the cusp with the help of **chordae tendinae.**
- Anterior papillary muscles → **largest**
- **Supraventricular ridge/crest** → separates the smooth outflowing part above, known as the INFUNDIBULUM with the inflowing rough part.

PLEURA, RECESS, SIBSON'S FASCIA

Pleura 00:00:37

- Covering of the lungs
- 2 layers;
  - Visceral pleura (Inner)
  - Parietal pleura (Outer)

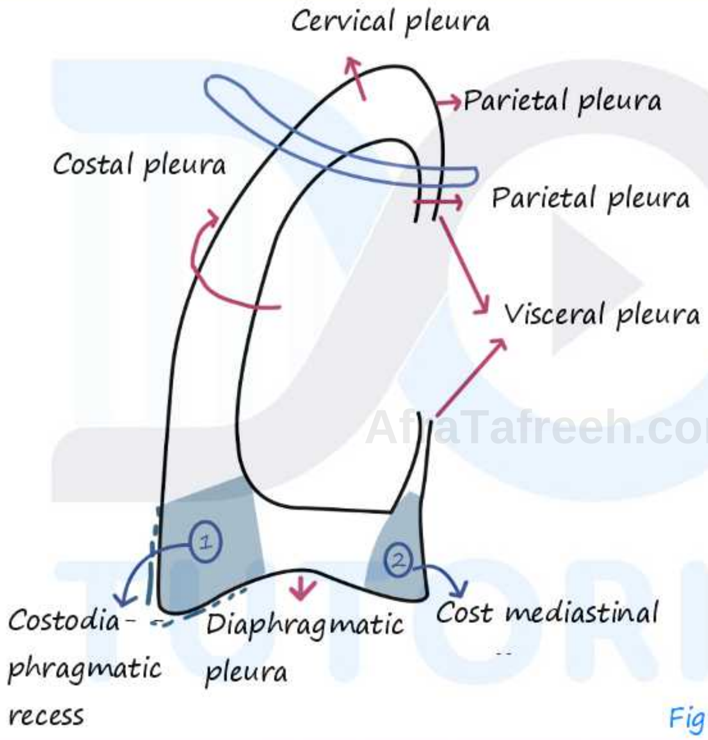

Cervical pleura
Parietal pleura
Costal pleura
Parietal pleura
Visceral pleura
1
2
Costodia-phragmatic recess
Diaphragmatic pleura
Cost mediastinal

Fig: 1

- Pleural fluid → approximately 5ml
- Parietal pleura:
  - Towards the mediastinum → mediastinal pleura
  - Towards the costal surface → costal pleura
  - Diaphragmatic pleura
  - Cervical pleura → above the clavicle, projecting the root of the neck

Recess 00:04:21

Recess

Costodiaphragmatic recess
More inferior/ more dependent

Costomediastinal recess
More anterior

- In pleural effusion, more amount of fluid is accumulated in the costodiaphragmatic recess

↓

Pleural tap → mid-axillary line → more dependent

Sibson's fascia/ supra pleural membrane 00:09:00

- Above cervical pleura
- Represents the degenerated part of scalenus medius muscle

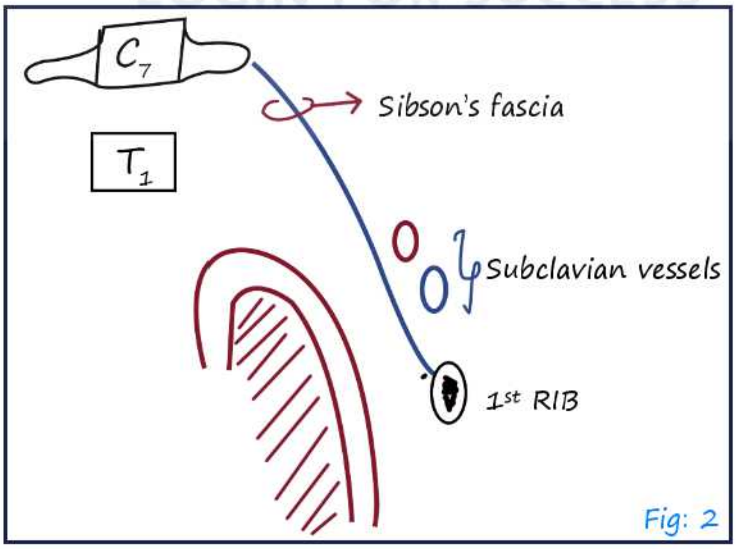

C_7
T_1
Sibson's fascia
Subclavian vessels
1st RIB

Fig: 2

- Subclavian vessels (subclavian artery and subclavian vein) are present above the Sibson's fascia in relation with the thoracic inlet

TRACHEOBRONCHIAL TREE AND ROOT OF LUNG

Tracheo-Bronchial Tree 00:00:06

Right primary bronchus:

- Wider
- Shorter
- More vertical

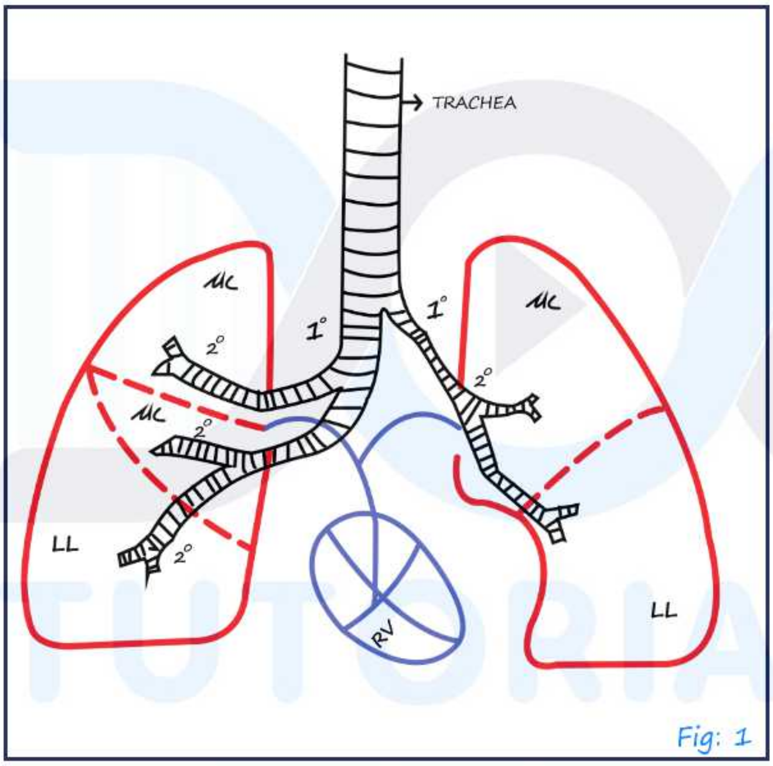


Fig: 1

Bronchus

- Primary/Principal bronchus → lung
- Secondary bronchus → LOBAR branches → LOBES
- Tertiary brochus → SEGMENTAL bronchus → SEGMENTS

E – Eparterial bronchus

H – Hyparterial bronchus

- Trachea bifurcates at T_4 in cadaver

T_6 normally

Root of the Lung 00:13:17

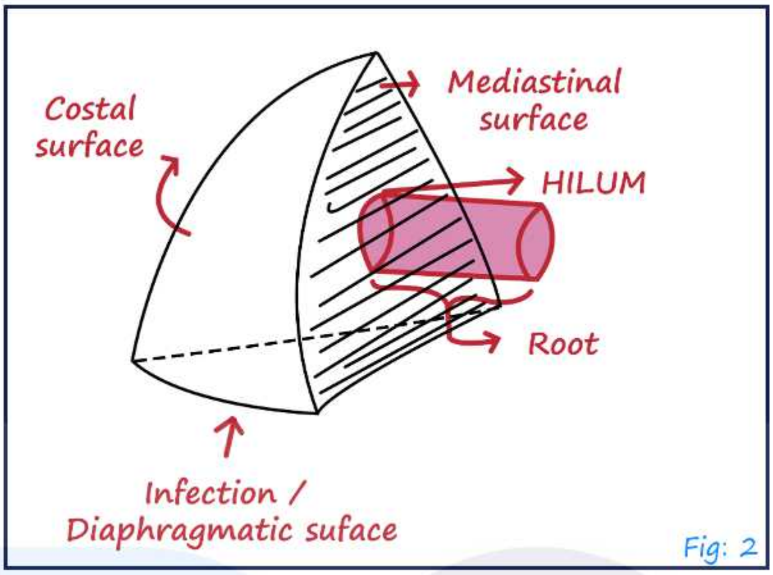

Costal surface
Mediastinal surface
HILUM
Root
Infection / Diaphragmatic suface

Fig: 2

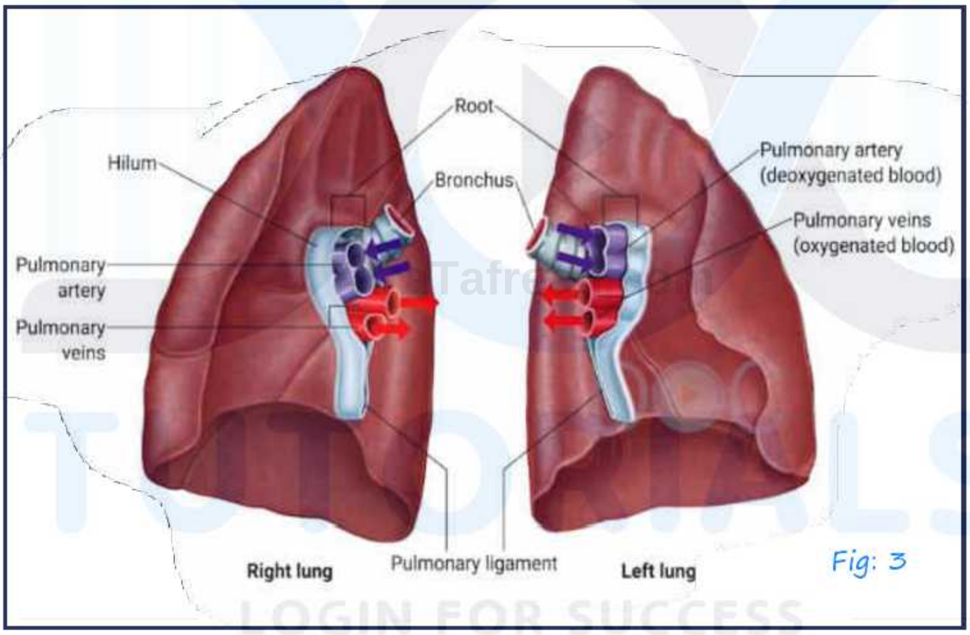

Root
Hilum
Bronchus
Pulmonary artery (deoxygenated blood)
Pulmonary veins (oxygenated blood)
Pulmonary artery
Pulmonary veins
Right lung
Pulmonary ligament
Left lung

Fig: 3

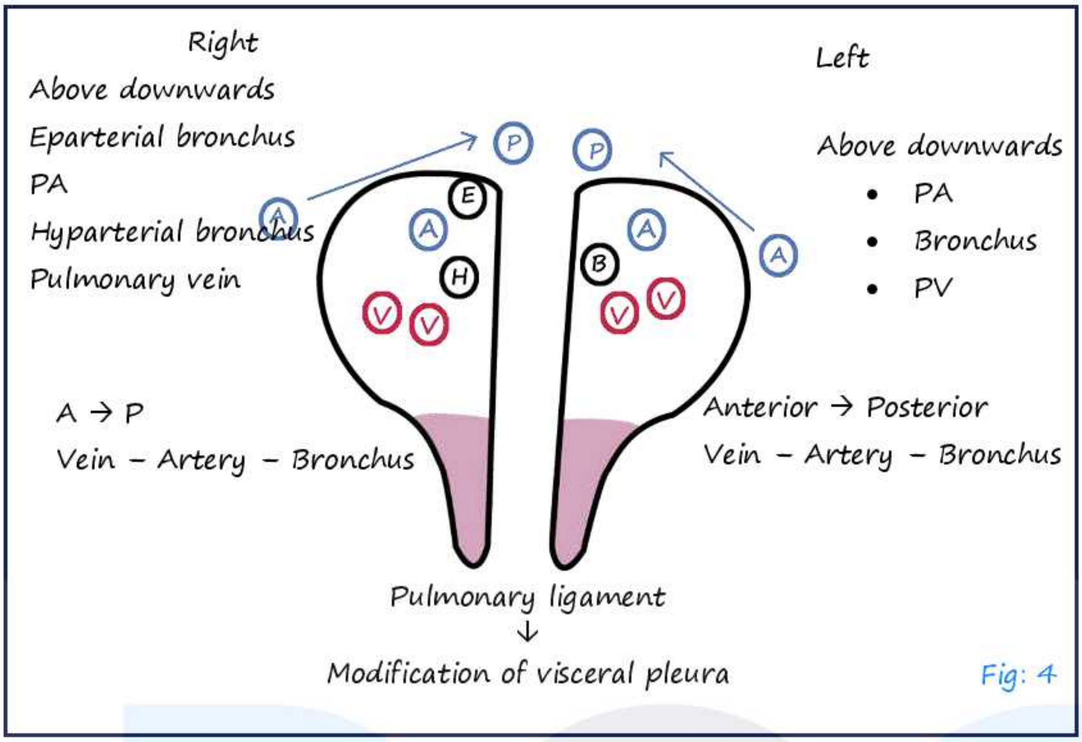

Right
Above downwards
Eparterial bronchus
PA
Hyparterial bronchus
Pulmonary vein
A → P
Vein – Artery – Bronchus
P
P
E
A
H
V
V
A
A
B
A
V
V
Left
Above downwards
• PA
• Bronchus
• PV
Anterior → Posterior
Vein – Artery – Bronchus
Pulmonary ligament
↓
Modification of visceral pleura

Fig: 4

DOT TUTORIALS

- Increased venous pressure requires dead space which is provided by the pulmonary ligament.
- Above the root of the right lung, there is an impression of the arch of the azygous.
- Above the root of the left lung, arch of aorta is present.

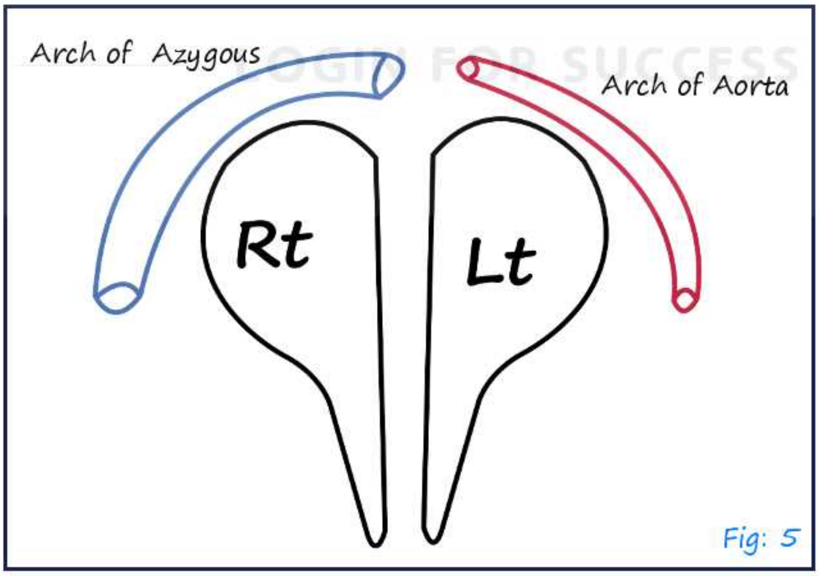

Arch of Azygous
Arch of Aorta
Rt
Lt

Fig: 5

BRONCHOPULMONARY SEGMENTS

Bronchopulmonary Segments 00:00:13

- Definition – It is a part of the lung aerated by TERITARY BRONCHUS/SEGMENTAL BRONCHUS.
- Shape: pyramidal
  - Apex is directed towards the hilum of the lung.
- Number: 10 bronchopulmonary segments in each lung.

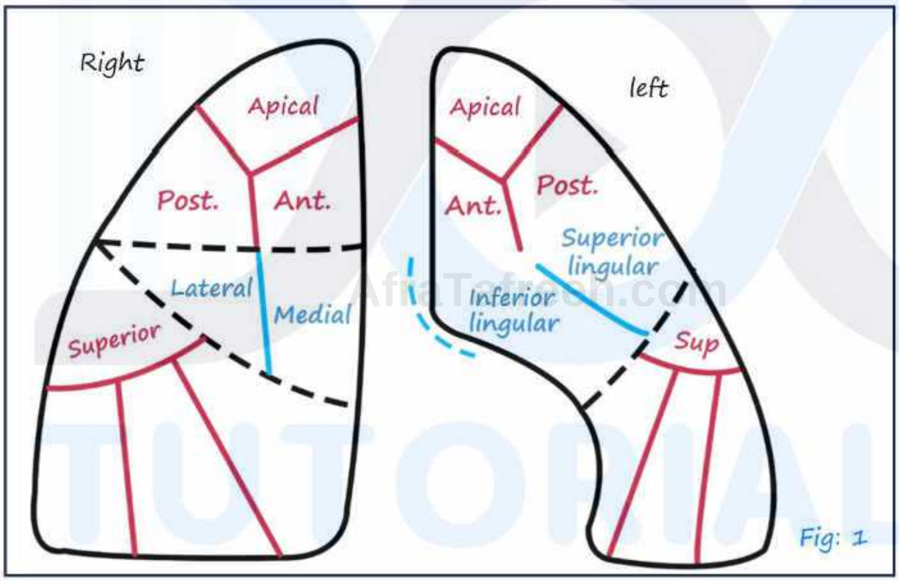

Right
Apical
Post.
Ant.
Lateral
Medial
Superior
left
Apical
Ant.
Post.
Superior lingular
Inferior lingular
Sup

Fig: 1

DOC TUTORIALS LOGIN FOR SUCCESS AfraTafreeh.com

4 Basal segment — Anterior — 4 Basal

Posterior

Medial

Lateral

Note

1. Right posterior basal – Most dependent Bronchopulmonary segment (BPS) in erect/standing position.

2. Rt superior – Most dependent BPS in supine position.

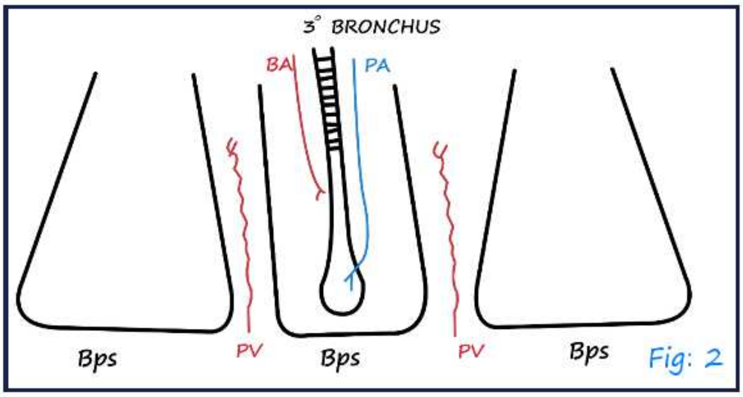


Fig: 2

- Each bronchopulmonary segment is separated by a septum which is the extension of VISCERAL PLEURA.
- Bronchial artery supplies only up to the respiratory bronchioles, while pulmonary artery supplies from thereafter.
- Each BPS has tertiary bronchus and pulmonary artery individually, but pulmonary vein is intersegmental.

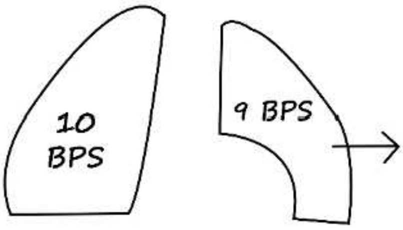
  ∴ BPS cannot be called as Bronchovascular segment.

3.BRONCHIAL ARTERY

- Supplies up to respiratory bronchiole.
- Right lung – 1. BA ← right 3rd intercostal artery.

  Left lung – 2. BA ← Descending Thoracic Aorta.

4. In many people, – Right lung has 10 segments and
   – Left lung has only 9 BPS because the medial basal segment is usually absent in order to accommodate the heart.



Absence of medial basal segment to accommodate the heart.

- When the left lung has 8 BPS → The apical & posterior BPS are fused together → APICOPOSTERIOR BPS.
- Left lung 9>8>10 BPS

5.

Organ	No. of Segments
Lung	10
Liver	8
Kidney	5

MEDIASTINAL SURFACE OF LUNGS AND THORACIC DUCT

Mediastinal Surface of Lungs 00:00:10

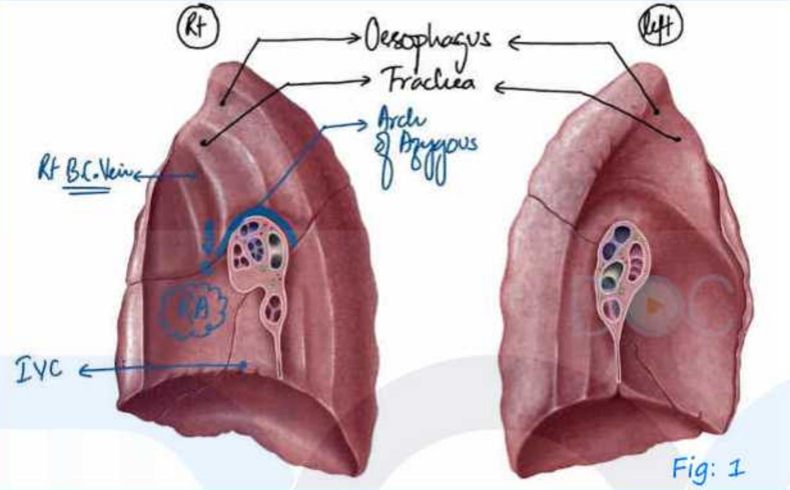

Rt
left
Oesophagus
Trachea
Arch of Azygous
Rt B.C. Vein
RA
IVC

Fig: 1

Thoracic duct 00:08:28

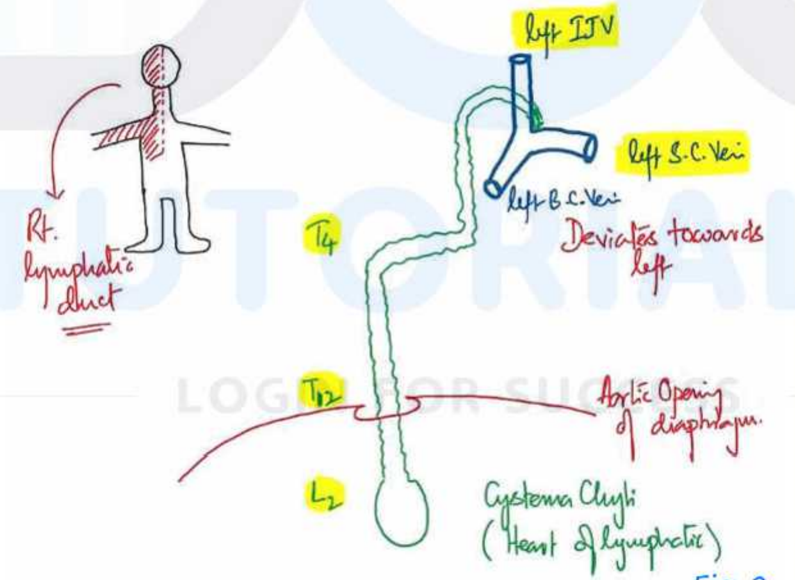

left IJV
left S.C. Vein
left B.C. Vein
Deviates towards left
Rt. lymphatic duct
T4
T12
L2
Aortic Opening of diaphragm.
Cysterna Chyli (Heart of lymphatic)

Fig: 2

- Thoracic duct drains at the junction of left subclavian vein and left jugular vein
- Right lymphatic duct → drains from
  - Right head & neck
  - Right upper limb
  - Right part of thorax

ANTERIOR ABDOMINAL WALL, INGUINAL CANAL

Regions of abdomen 00:01:15

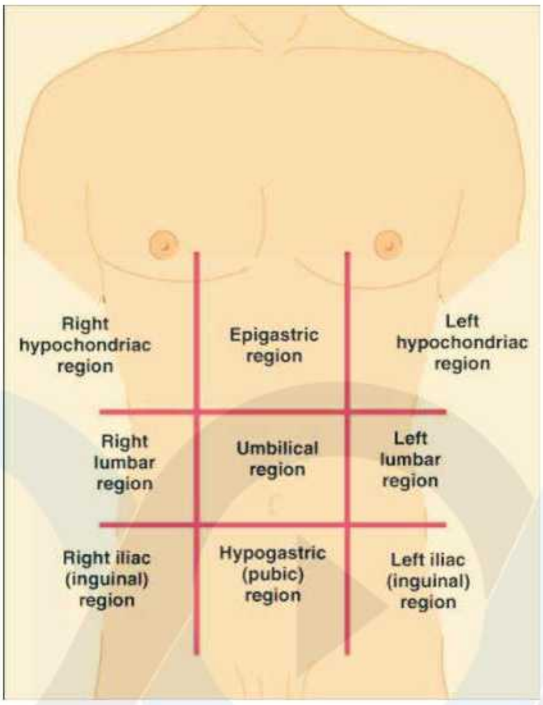
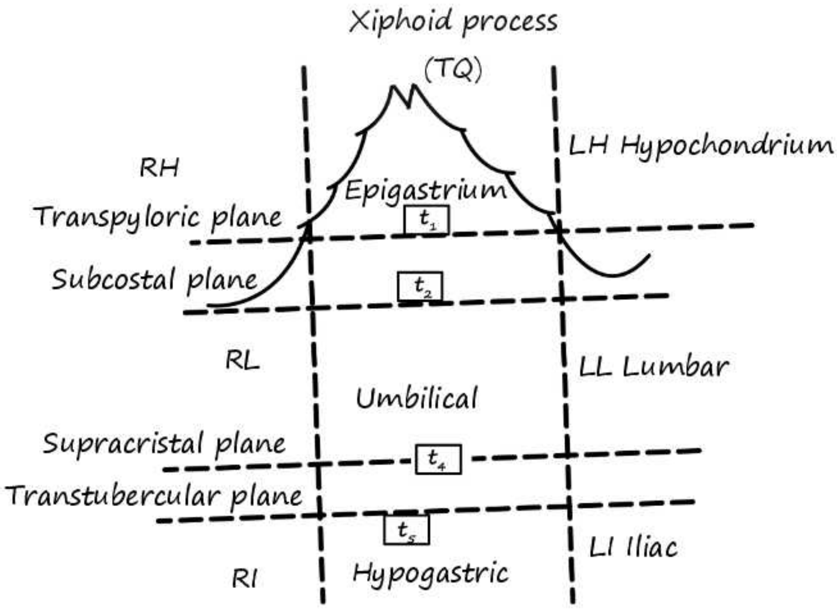

Right hypochondriac region
Epigastric region
Left hypochondriac region
Right lumbar region
Umbilical region
Left lumbar region
Right iliac (inguinal) region
Hypogastric (pubic) region
Left iliac (inguinal) region

Fig: 1

- 4 planes
  - 2 verticals
  - 2 horizontals
- Xiphoid process is at T_9 level


Xiphoid process
(T9)
LH Hypochondrium
RH
Transpyloric plane
Epigastrium
t_1
Subcostal plane
t_2
RL
LL Lumbar
Umbilical
Supracristal plane
t_4
Transtubercular plane
t_5
LI Iliac
RI
Hypogastric

- Subcostal plane → lower border of L_2
- Transtubercular plane → upper border of L_5
- Transpyloric plane → lower border of L_1
- Supracristal plane → body of L_4

Transpyloric plane

- Pylorus part of stomach
- Termination of spinal cord
- Origin of superior mesenteric artery
- Hilum of kidney
- Fundus of gall bladder
- Tip of 9th costal cartilage

Anterior abdominal wall – 8 layers 00:11:18

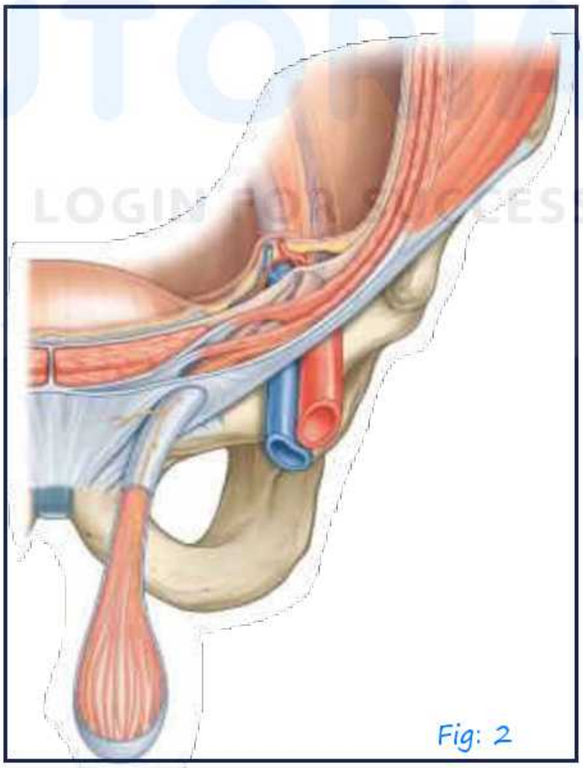


Fig: 2

1. Skin
2. Superficial fascia
    - Outer-fatty layer – Camper's Fascia
    - Inner-fibrous layer – Scarpa Fascia
3. External oblique muscle
4. Internal oblique muscle
5. Transversus abdominis muscle
6. Transversalis fascia
7. Extraperitoneal layer
8. Parietal peritoneum
    - External oblique aponeurosis from both sides comes to join in the middle as linea alba.

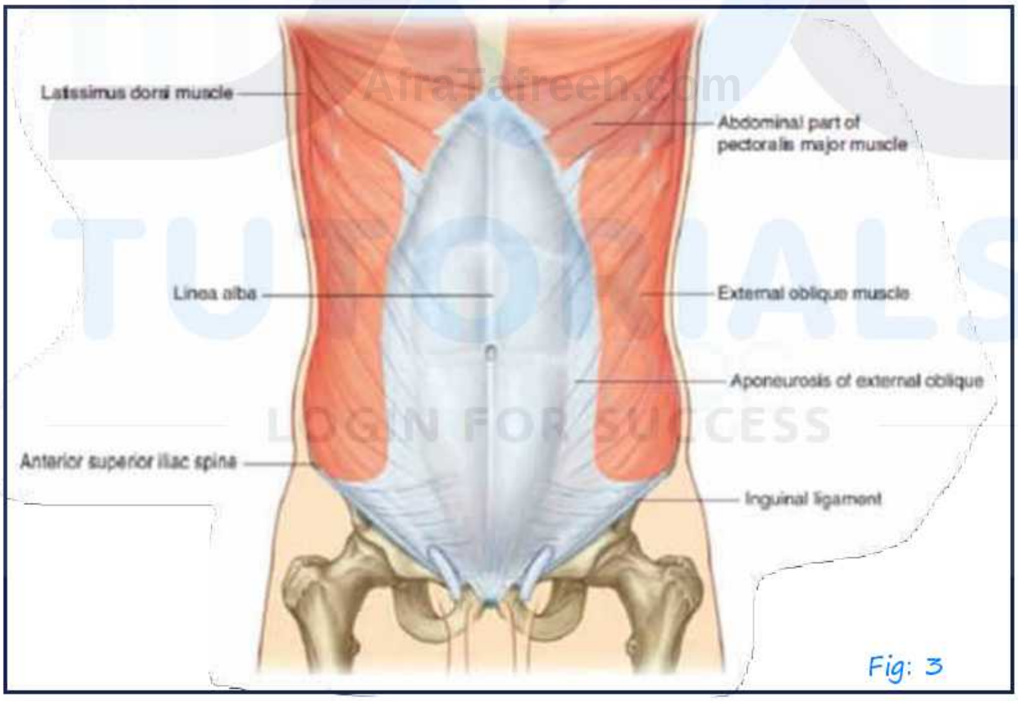

Latissimus dorsi muscle
Abdominal part of pectoralis major muscle
Linea alba
External oblique muscle
Aponeurosis of external oblique
Anterior superior iliac spine
Inguinal ligament

Fig: 3

Inguinal ligament 00:20:03

- Thickening of external oblique aponeurosis

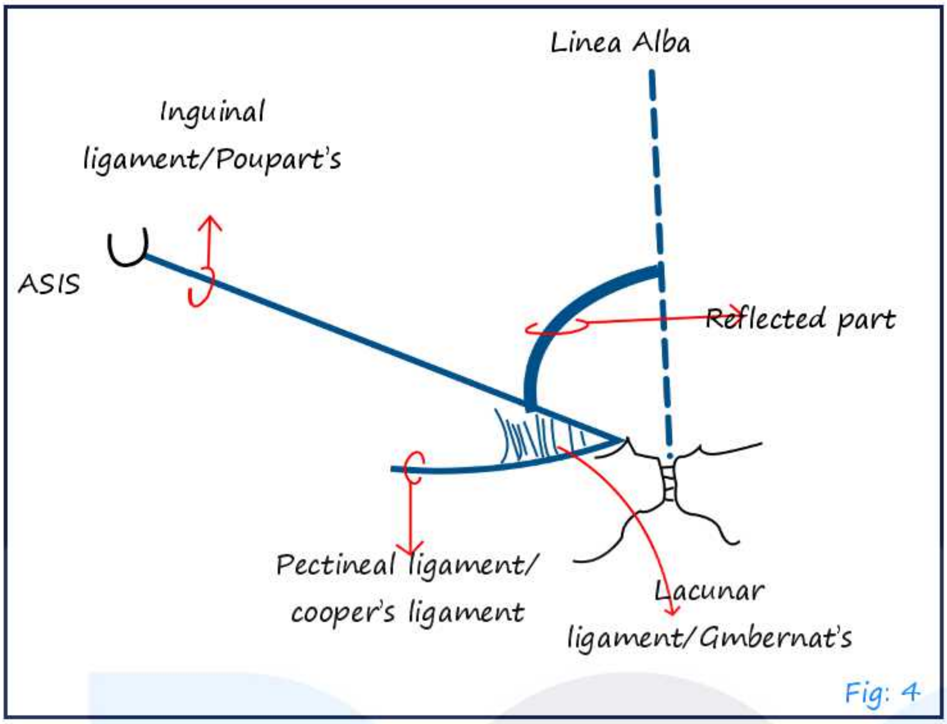

Linea Alba
Inguinal ligament/Poupart's
ASIS
Reflected part
Pectineal ligament/ cooper's ligament
Lacunar ligament/Gmbernat's

Fig: 4

- 3 modifications of inguinal ligament/ Poupart's ligament:
  1. Reflected part
  2. Lacunar ligament/ Gimbernat's ligament
  3. Pectineal ligament/ Cooper's ligament
- Transversalis fascia has an oval shaped opening (or) a defect in the transversalis fascia → **deep inguinal ring**
- External oblique aponeurosis has a triangle shaped opening known as **superficial inguinal ring**
- Layers in between superficial and deep inguinal rings:
  1. External oblique
  2. Internal oblique
  3. Transversus abdominis
- Conjoint tendon/ Falx inguinalis → made up of IO + TA

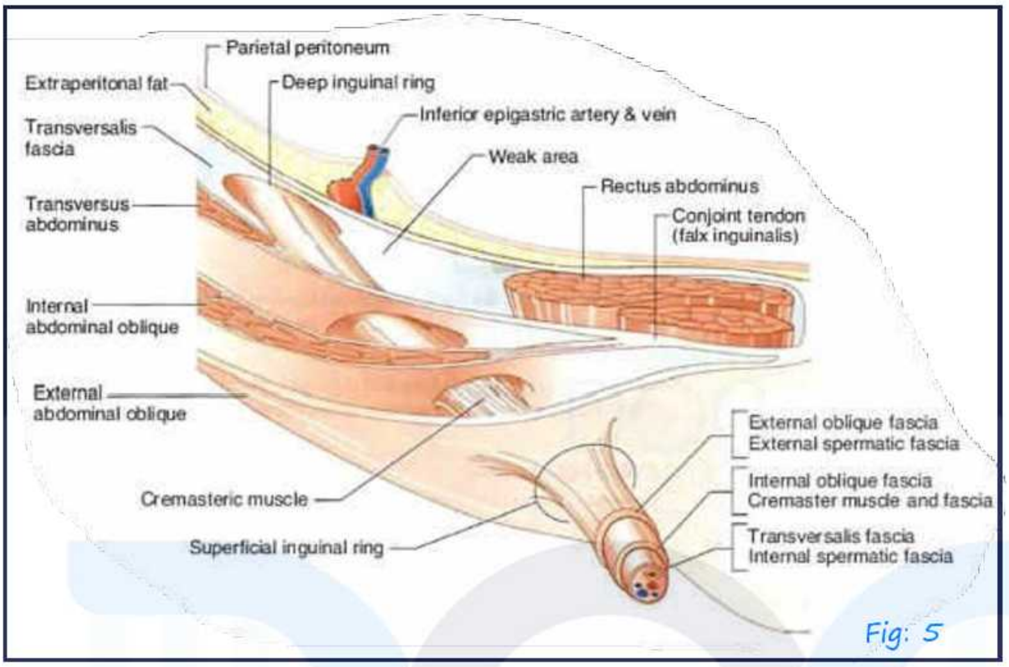

Parietal peritoneum
Extraperitonal fat
Deep inguinal ring
Inferior epigastric artery & vein
Transversalis fascia
Weak area
Rectus abdominus
Transversus abdominus
Conjoint tendon (falx inguinalis)
Internal abdominal oblique
External abdominal oblique
External oblique fascia
External spermatic fascia
Internal oblique fascia
Cremaster muscle and fascia
Cremasteric muscle
Superficial inguinal ring
Transversalis fascia
Internal spermatic fascia

Fig: 5

- It extends from deep inguinal ring to superficial inguinal ring
- Location: Above and medial to inguinal ligament
- Length: 4cms/ 3.8cm/ 3.75cm

DOT TUTORIALS
LOGIN FOR SUCCESS

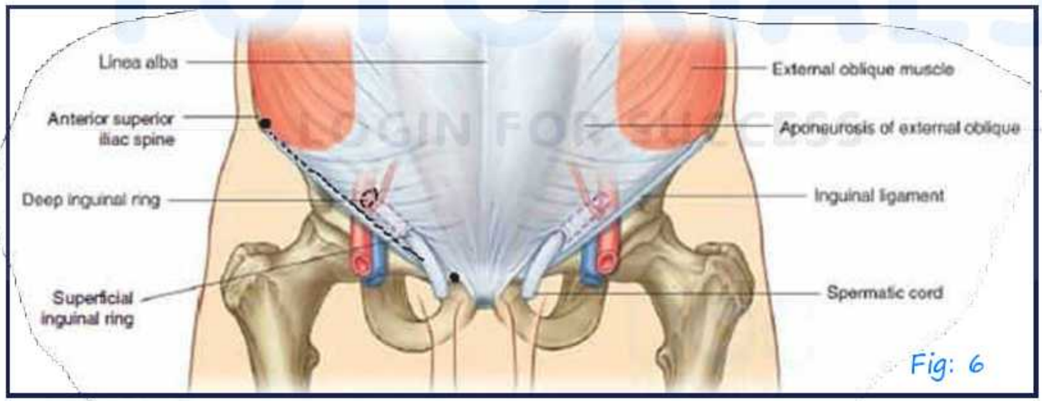

Linea alba
External oblique muscle
Anterior superior iliac spine
Aponeurosis of external oblique
Deep inguinal ring
Inguinal ligament
Superficial inguinal ring
Spermatic cord

Fig: 6

- Boundaries:

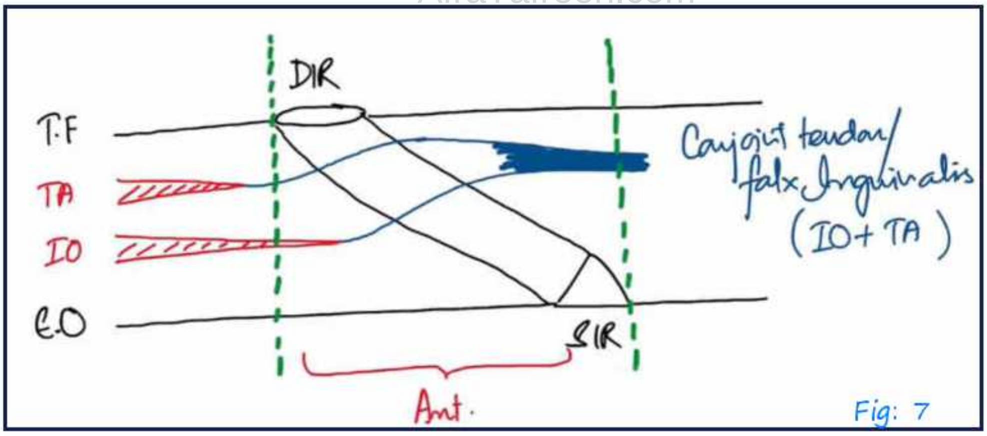

DIR
T.F
TA
IO
EO
SIR
Conjoint tendon/ falx Inguinalis (IO+TA)
Ant.

Fig: 7

- Anterior boundary
    - External oblique (completely)
    - Internal oblique (laterally)
- Posterior boundary
    - Transversalis fascia (complete)
    - Conjoint tendon
    - Reflected part
- Superior boundary
    - Internal oblique + Transversus abdominis
- Inferior boundary
    - Inguinal ligament + lacunar ligament

Contents of inguinal canal 00:39:39

Male	Female
Spermatic cord (True content)	Round ligament of uterus (true content)
Ilioinguinal nerve (L_1) (False content)	Ilioinguinal nerve (L_1) (False content)

Spermatic cord 00:41:39

1. External spermatic fascia ← external oblique aponeurosis
2. Cremasteric muscle and fascia ← internal oblique aponeurosis
3. Internal spermatic fascia ← transversalis fascia
4. Testicular artery
5. Pampiniform plexus of veins
6. Genital branch of genitofemoral nerve
7. Vas deferens/ ductus deferens ← branch of superior vesicular artery
8. Remnant of processus vaginalis
9. Cremasteric vessels

DOCTUTORIALS LOGIN FOR SUCCESS

True content

- Any content that enters the DIR and comes out through SIR
- Ex. Spermatic cord & round ligament of uterus

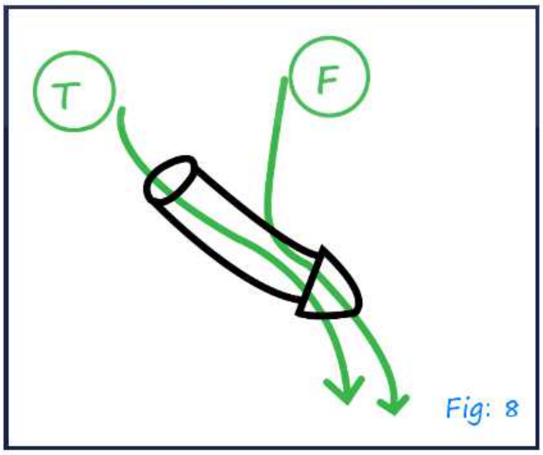


Fig: 8

False content

- Content that pierce the posterior wall, enter the inguinal canal and come out from SIR
- Ex. Ilioinguinal nerve

Inguinal hernia 00:53:34

Inguinal hernia

- **Direct inguinal hernia**
  Via Hesselbach's triangle
- **Indirect inguinal hernia**
  Via deep inguinal ring

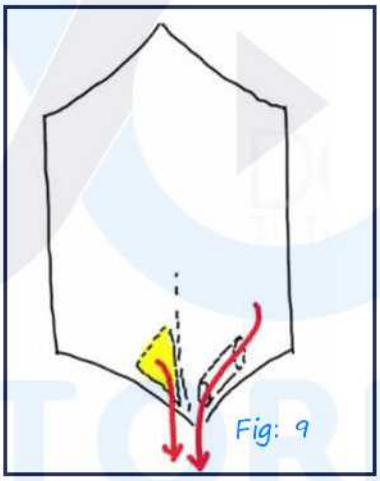


Fig: 9

DOC TUTORIALS
LOGIN FOR SUCCESS

Hesselbach's triangle/ Inguinal triangle 00:55:49

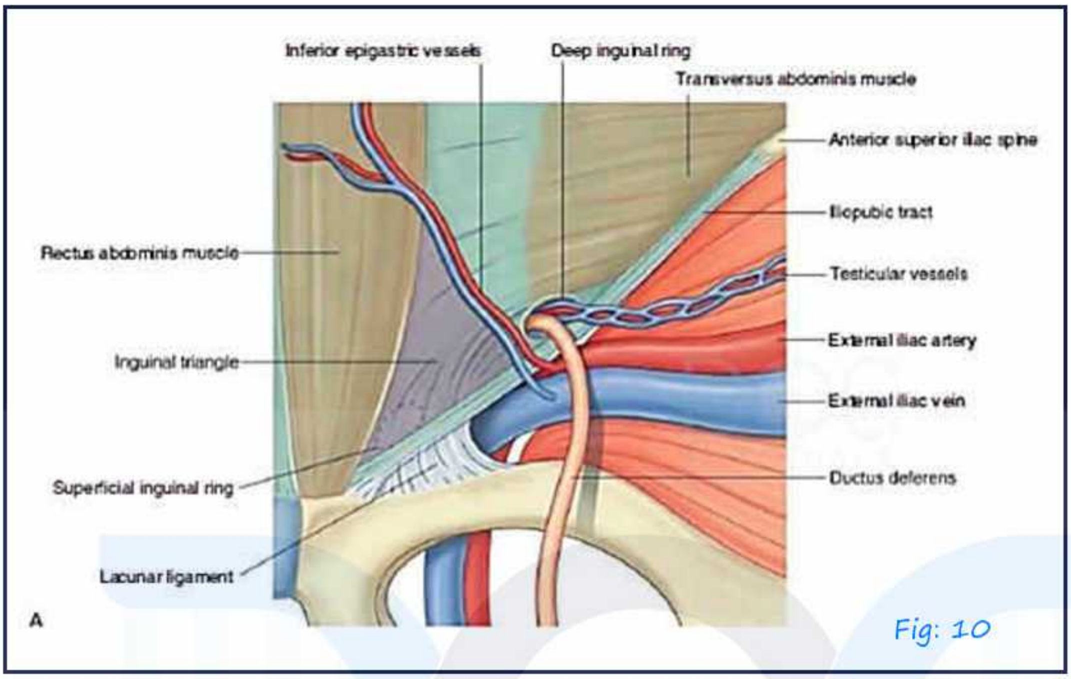

Inferior epigastric vessels
Deep inguinal ring
Transversus abdominis muscle
Anterior superior iliac spine
Iliopubic tract
Rectus abdominis muscle
Testicular vessels
External iliac artery
Inguinal triangle
External iliac vein
Superficial inguinal ring
Ductus deferens
Lacunar ligament
A

Fig: 10

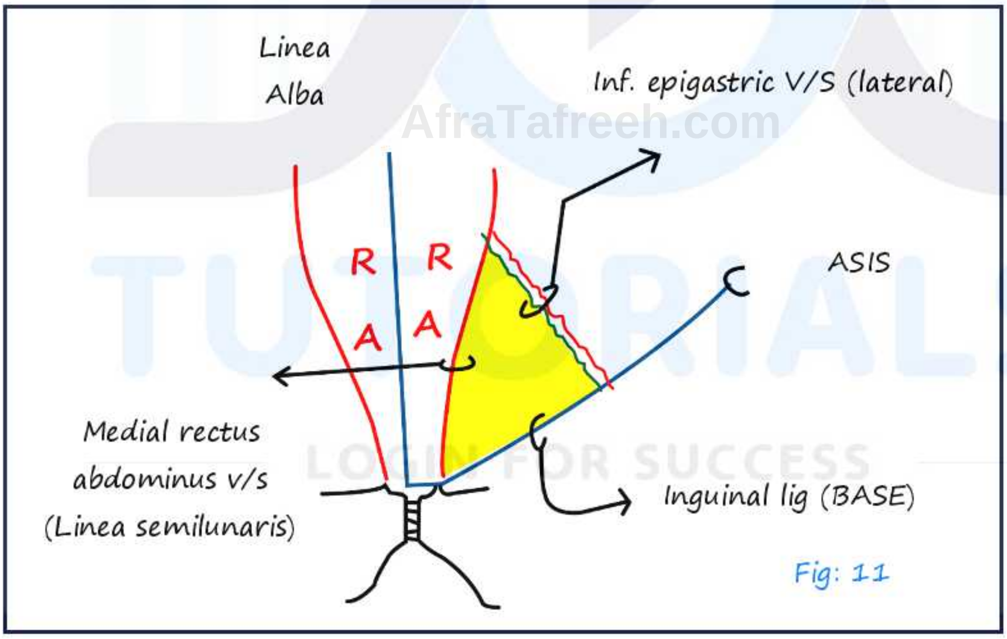

Linea
Alba
Inf. epigastric V/S (lateral)
R
R
A
A
ASIS
Medial rectus
abdominus v/s
(Linea semilunaris)
Inguinal lig (BASE)

Fig: 11

- **Base** → inguinal ligament
- **Medial boundary** → lateral border of rectus abdominis known as linea semilunaris
- **Lateral boundary** → inferior epigastric vessels

RECTUS SHEATH, POSTERIOR ABDOMINAL WALL, THORACOLUMBAR FASCIA

Rectus Sheath 00:00:09

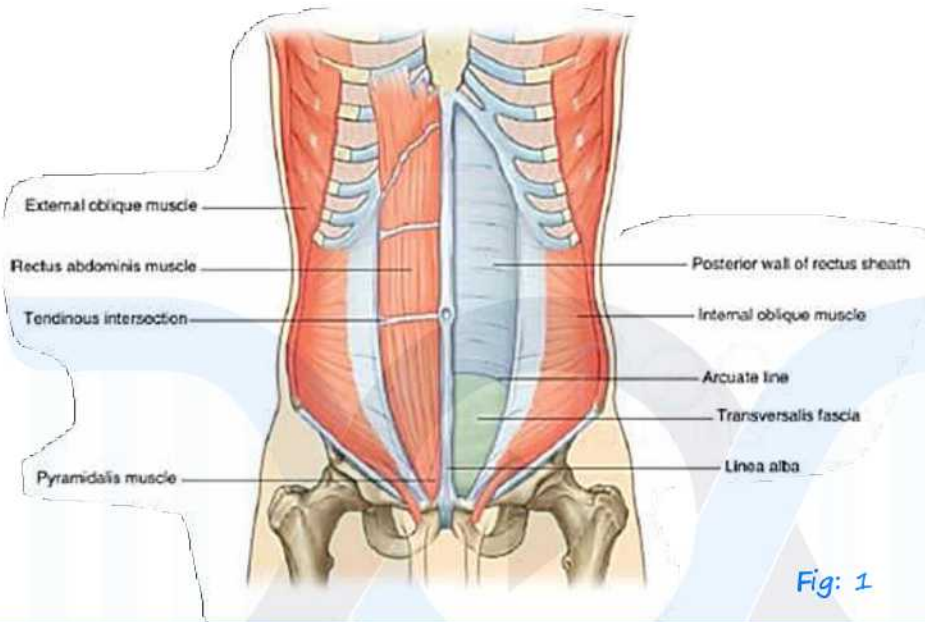

External oblique muscle
Rectus abdominis muscle
Tendinous intersection
Pyramidalis muscle
Posterior wall of rectus sheath
Internal oblique muscle
Arcuate line
Transversalis fascia
Linea alba

Fig: 1

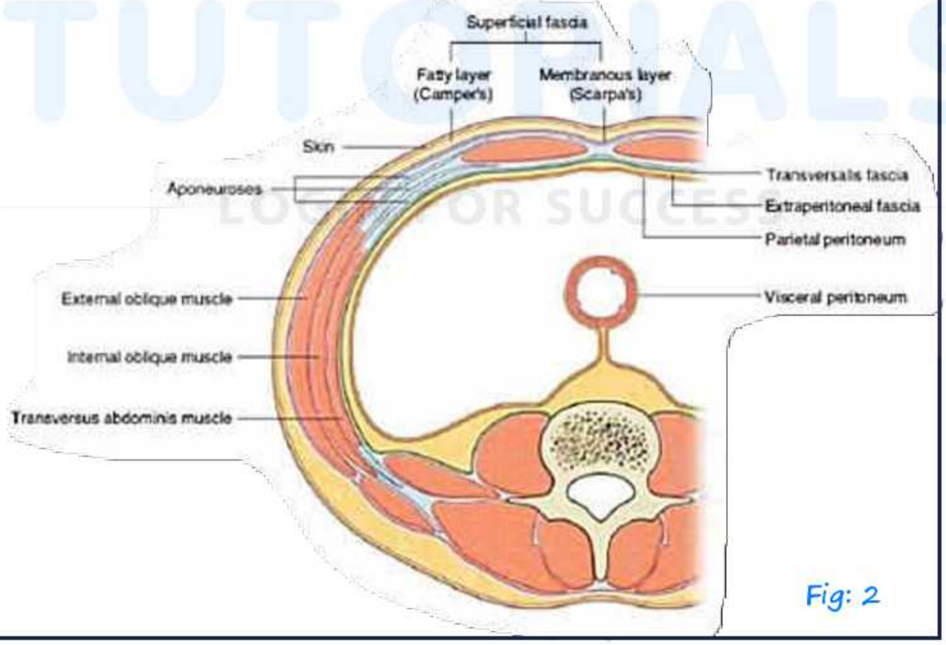

Superficial fascia
Fatty layer (Camper's)
Membranous layer (Scarpa's)
Skin
Aponeuroses
External oblique muscle
Internal oblique muscle
Transversus abdominis muscle
Transversalis fascia
Extraperitoneal fascia
Parietal peritoneum
Visceral peritoneum

Fig: 2

DOT TUTORIALS
LOOK FOR SUCCESS

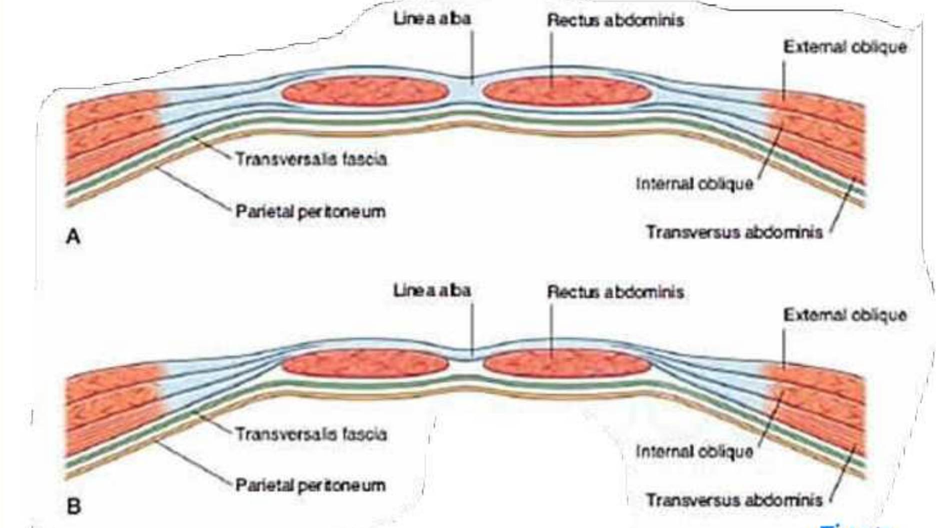

Linea alba
Rectus abdominis
External oblique
Transversalis fascia
Parietal peritoneum
Internal oblique
Transversus abdominis
A
Linea alba
Rectus abdominis
External oblique
Transversalis fascia
Parietal peritoneum
Internal oblique
Transversus abdominis
B

Fig: 3

- It is formed by aponeurosis of external oblique, internal oblique, and transversus abdominis
  - Arcuate line: Between umbilicus and pubic symphysis
  - Boundaries

    Above Arcuate line

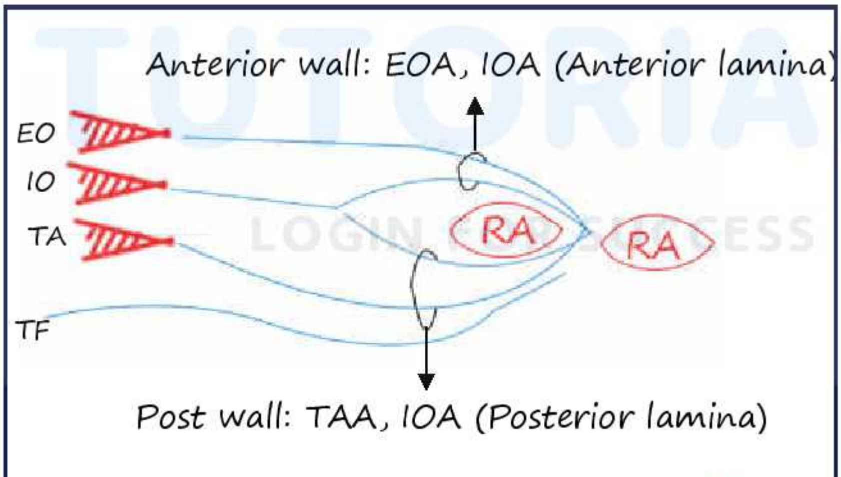

Anterior wall: EOA, IOA (Anterior lamina)
EO
IO
TA
TF
RA
RA
Post wall: TAA, IOA (Posterior lamina)

Fig: 4

Below Arcuate line

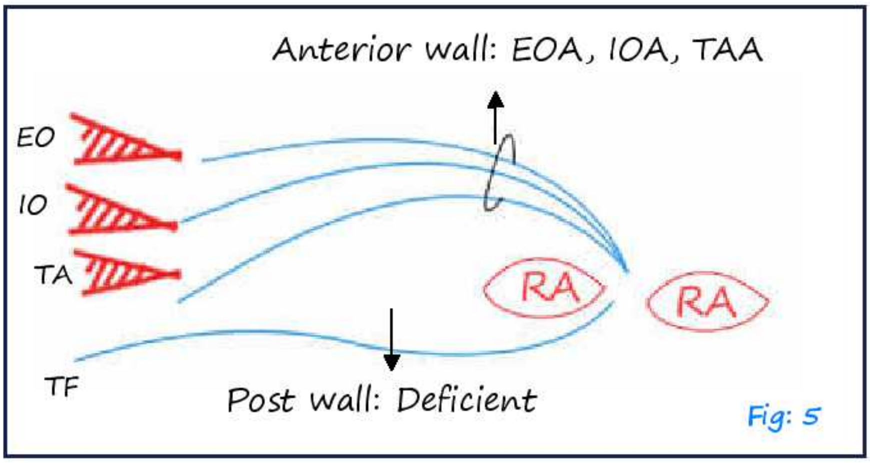

Anterior wall: EOA, IOA, TAA
EO
IO
TA
RA
RA
TF
Post wall: Deficient

Fig: 5

- Below the arcuate line the layer present just behind the rectus abdominis is **Transversalis fascia.**
- Posterior wall of rectus sheath below the arcuate line is **deficient.**

Contents

2 muscles
- Rectus abdominis
- Pyramidalis

2 Vessels
- Superior epigastric artery & vein
- Inferior epigastric artery & vein

Nerves – Lower 6 Thoracic nerves (T_7-T_{12})

T_7-T_{11} → Intercostal nerves

T_{12} → Subcostal

TUTORIALS LOGIN FOR SUCCESS

Thoraco-Lumbar Fascia 00:16:14

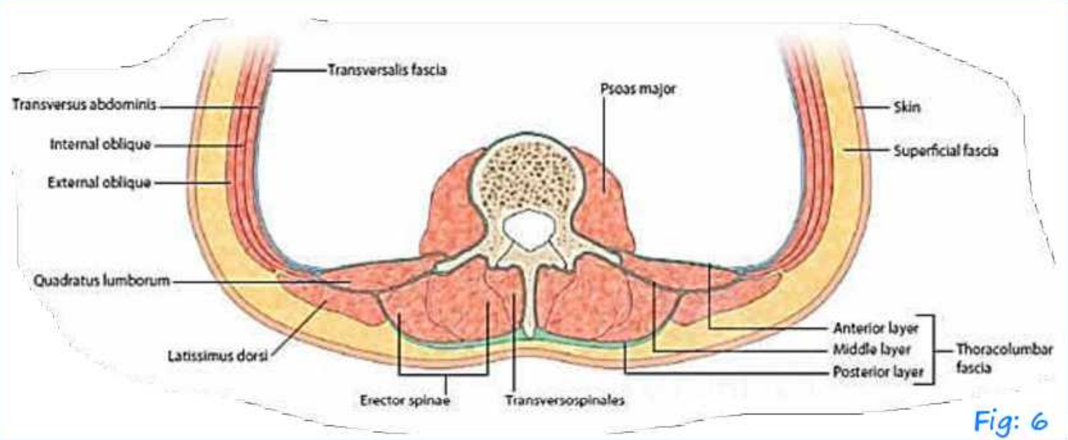

Transversalis fascia
Psoas major
Transversus abdominis
Internal oblique
External oblique
Skin
Superficial fascia
Quadratus lumborum
Latissimus dorsi
Anterior layer
Middle layer
Posterior layer
Thoracolumbar fascia
Erector spinae
Transversospinales

Fig: 6

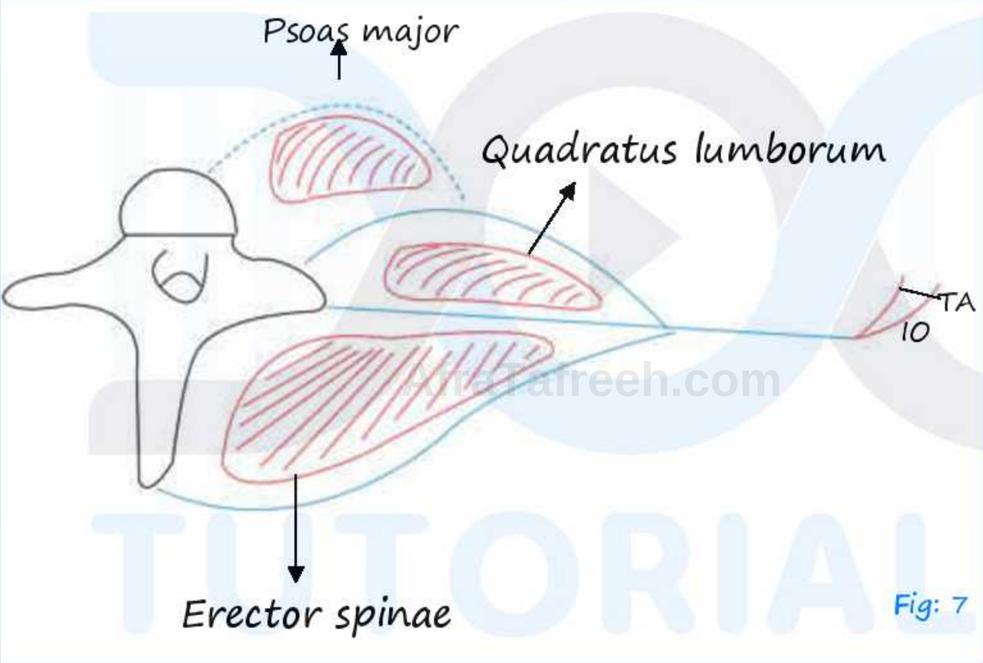

Psoas major
Quadratus lumborum
TA
IO
Erector spinae

Fig: 7

DOC TUTORIALS
LOGIN FOR SUCCESS

- Thoracolumbar fascia – 3 layers:

  1. Anterior layer
  2. Middle layer
  3. Posterior layer

  - Quadratus lumborum muscle → present between the anterior and middle layers.
  - Erector spinae/true back muscle → middle & posterior layer
  - Psoas major → covered by psoas major fascia.

- Thoracolumbar fascia encloses 3 muscles: -
  i. Quadratus lumborum
  ii. Erector spinae
  iii. Psoas major
- Internal oblique } Originate from
  Transverse abdominis } Thoracolumbar fascia

STOMACH DIAPHRAGM

Stomach 00:00:40

Relations

- To lesser curvature
  - Lesser omentum
- To greater curvature
  - Greater omentum
  - Gastrosplenic ligament
  - Gastrophrenic ligament

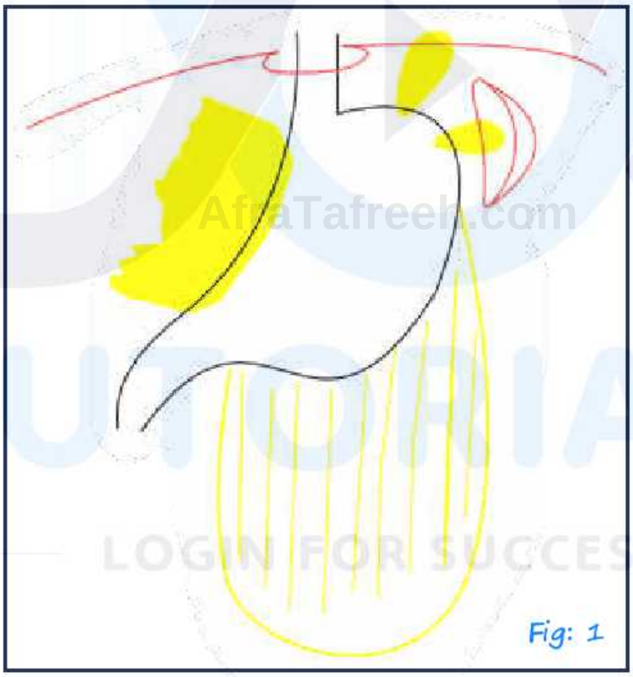


Fig: 1

Posterior surface relations/ stomach bed relations 00:04:28

- Dr – Diaphragm
- S – Splenic artery
- S – Splenic flexure of colon
- S – Ⓛ Suprarenal gland

- Killed – Ⓛ Kidney
- Patient – Pancreas
- Mercilessly – Transverse Mesocolon

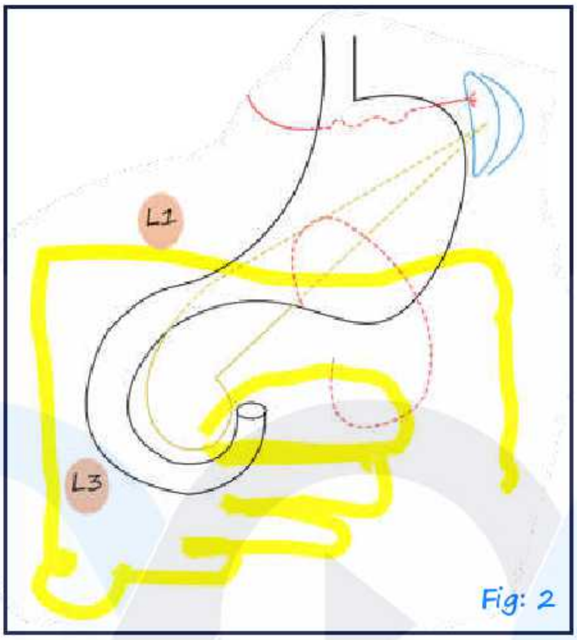


Fig: 2

Arterial supply 00:12:58

- Along lesser curvature
  - Right & left gastric arteries
- Along greater curvature
  - Right & left gastro-epiploic arteries
- Along fundus
  - Short gastric arteries

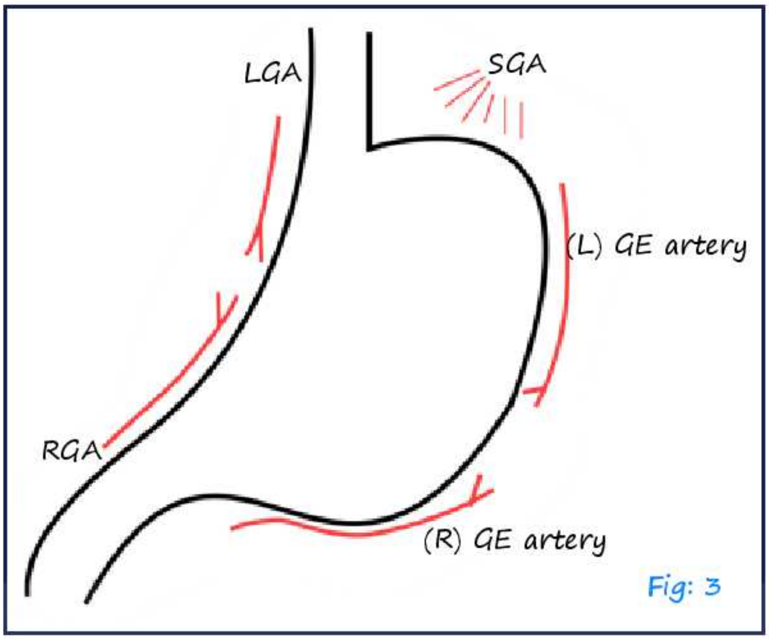

LGA
SGA
(L) GE artery
RGA
(R) GE artery

Fig: 3

Diaphragm 00:16:37

- Musculotendinous structure
- Nerve supply: Phrenic nerve (C_3, C_4, C_5)

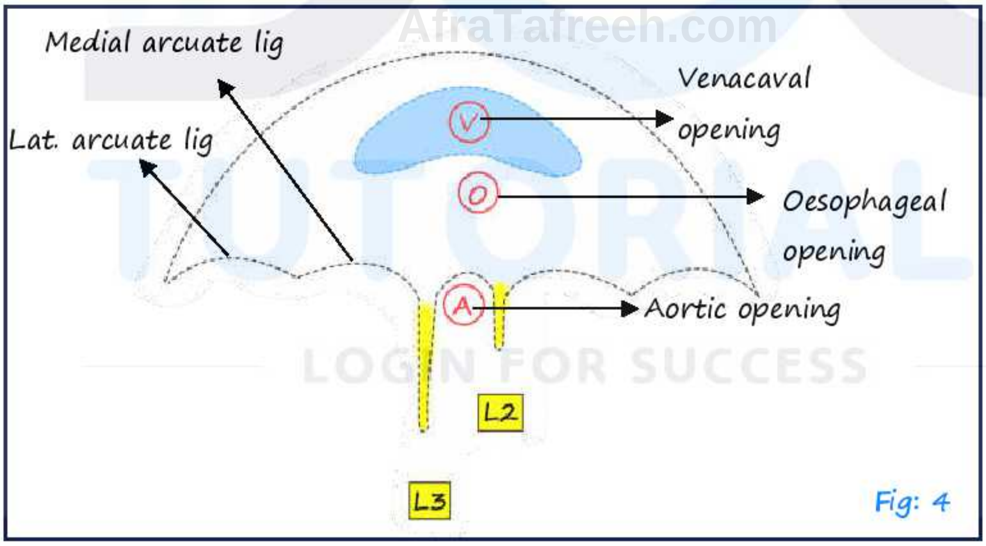

Medial arcuate lig
Lat. arcuate lig
V
Venacaval opening
O
Oesophageal opening
A
Aortic opening
L2
L3

Fig: 4

- Vernacular opening (T8) → IVC, Rt, Pheresis M/V
- Oesophageal opening (T10) → Oesophagus, Oesophageal Br of LG
- Aorta, Thoracic duct, Azygous vein
- Medial arcuate lig: (Psoas major fascia)

- Lat. Arcuate lig (Quadratus lumborum (or) Thoraco lumbar fascia

Major openings

1. Venacaval opening (T_8)
   - IVC, Rt. Phrenic nerve

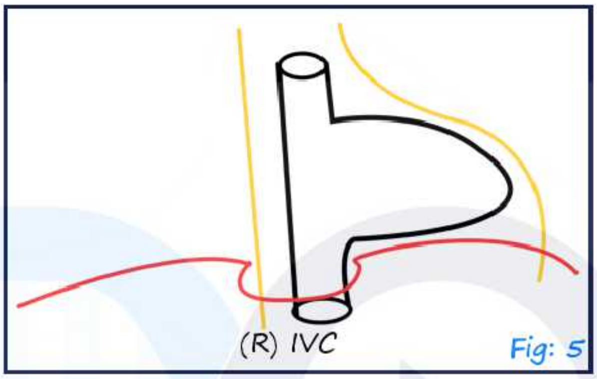


Fig: 5

2. Oesophageal opening (T_{10})
   - Oesophagus
   - Oesophageal branches of left gastric artery
   - Vagus nerves
3. Aortic opening (T_{12})
   - Aorta
   - Thoracic duct
   - Azygous vein

Minor opening of diaphragm 00:16:37

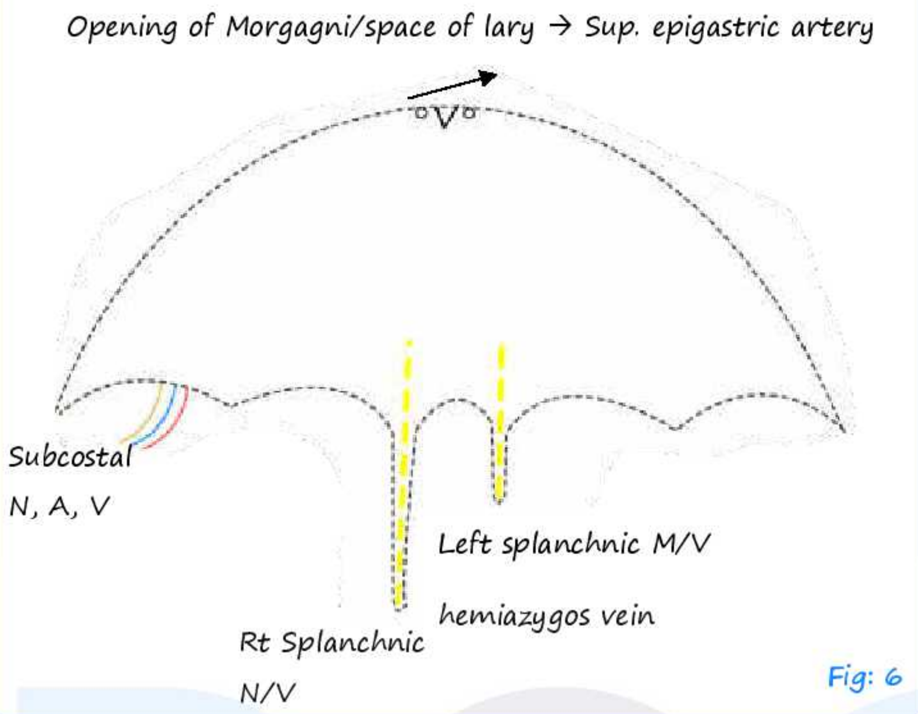

Opening of Morgagni/space of lary → Sup. epigastric artery
Subcostal
N, A, V
Left splanchnic M/V
hemiazygos vein
Rt Splanchnic
N/V

Fig: 6

- Right crus → Right splanchnic nerve
- Left crus →
  - Left splanchnic nerve
  - Hemiazygous vein

ABDOMINAL AORTA CELIAC TRUNK

Abdominal aorta 00:00:47

- Extent: T_{12} → L_4 (lower border)

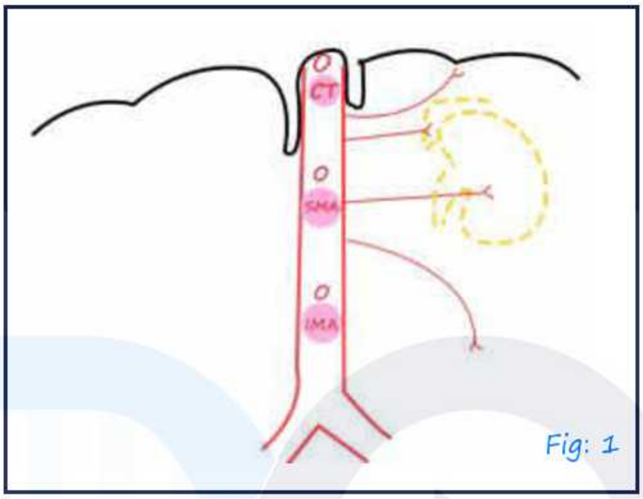


Fig: 1

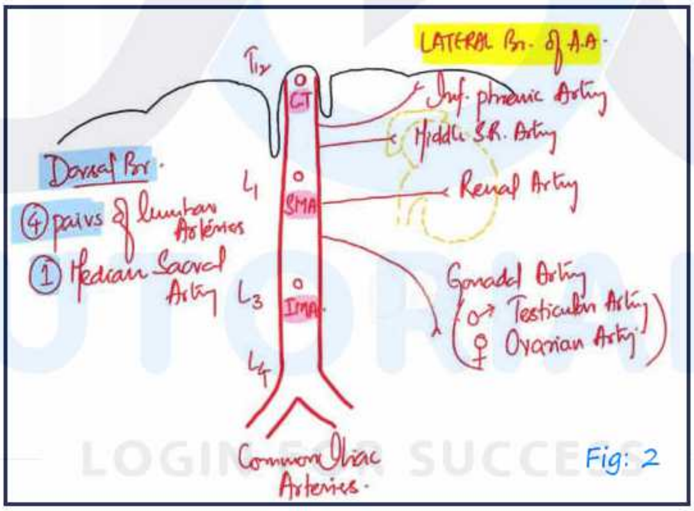

LATERAL Br. of A.A.
T12
CT
Inf. phrenic Artery
Middle S.R. Artery
Dorsal Br.
L1
SMA
Renal Artery
④ pairs of lumbar Arteries
① Median Sacral Artery
L3
IMA
Gonadal Artery
(♂ Testicular Artery)
(♀ Ovarian Artery)
L4
Common Iliac Arteries.

Fig: 2

Branches of abdominal aorta

- Ventral branches
  - Coeliac truck (lower border of T_{12}) → Foregut
  - Superior mesenteric artery (lower border of L_1) → Midgut
  - Inferior mesenteric artery (body of L_3) → Hindgut
- Lateral branches
  - Inferior phrenic artery

- Middle suprarenal artery
- Renal artery
- Gonadal artery
  - i. In males: - Testicular artery
  - ii. In females: - Ovarian artery

- Dorsal branches
  - 4 pairs of lumbar arteries
  - 1 median sacral artery

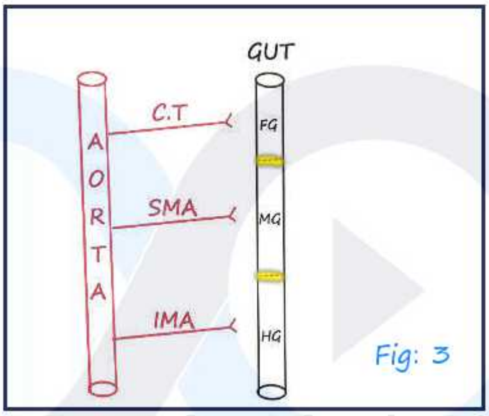
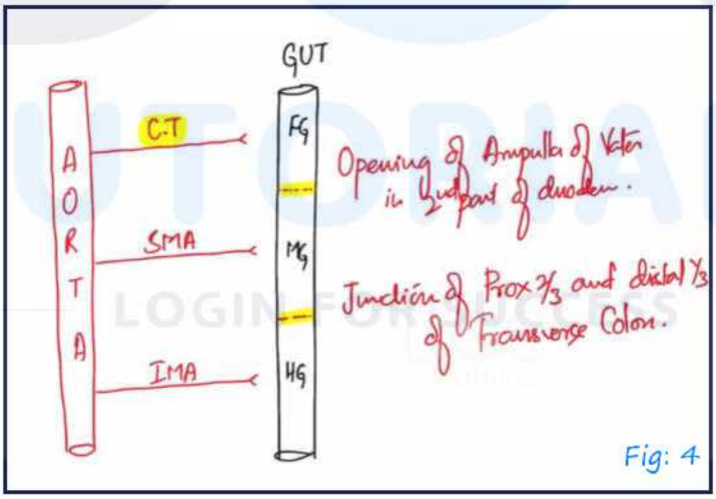

GUT
AORTA
C.T
SMA
IMA
FG
MG
HG

Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS


GUT
AORTA
C.T
SMA
IMA
FG
MG
HG

Opening of Ampulla of Vater in 2nd part of duoden.

Junction of Prox $\frac{2}{3}$ and distal $\frac{1}{3}$ of Transverse Colon.

Fig: 4

- Branches

Coeliac trunk
- **Left gastric artery**
- **Splenic artery**
- **Common hepatic artery**
  - Proper hepatic artery
    - Right gastric artery
    - Right hepatic artery
    - Left hepatic
  - Gastro-duodenal
    - Right gastro epiploic artery
    - Superior pancreatic duodenal artery

DOC TUTORIALS
LOGIN FOR SUCCESS

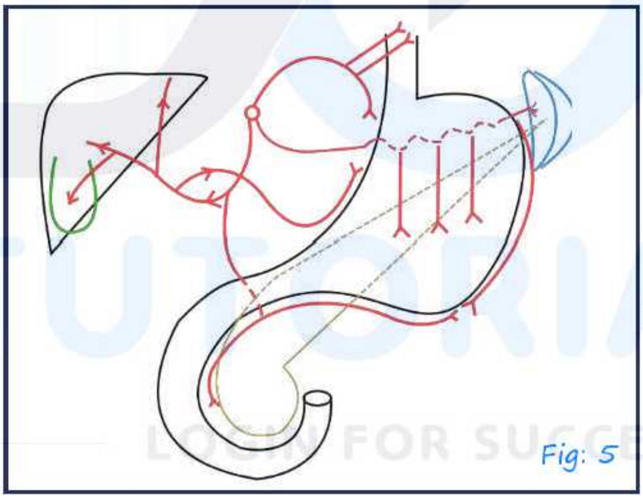


Fig: 5

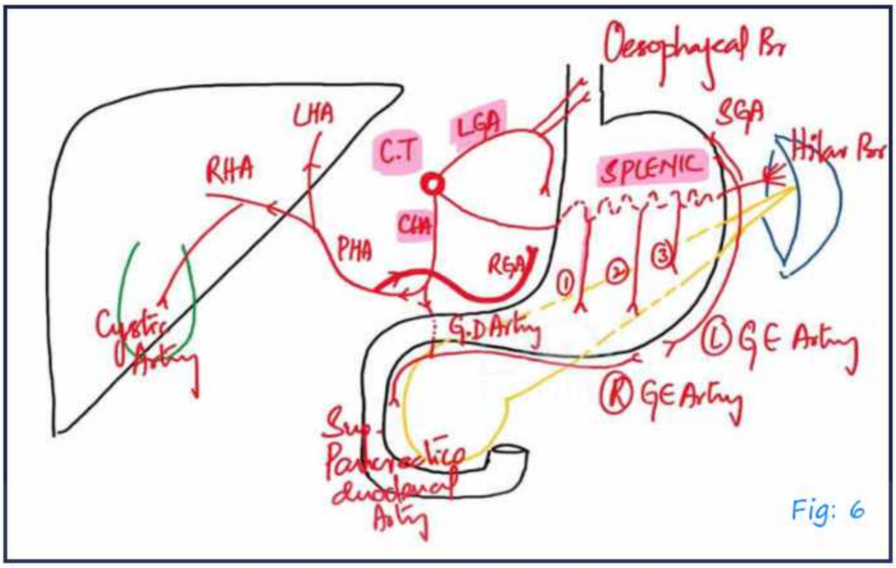

Oesophageal Br
SGA
Hilar Br
LHA
C.T
LGA
RHA
SPLENIC
CHA
PHA
RGA
①
②
③
Cystic Artery
G.D Artery
Ⓛ GE Artery
Ⓡ GE Artery
Sup. Pancreatico duodenal Artery

Fig: 6

- Splenic artery supplies to the body and tail of pancreas.
- Branches of splenic artery

  1.Dorsal pancreatic branch

  2.Arteria pancreatica magna

  3.Arteria pancreatica caudal

  4.Left gastro-epiploic artery

  5.Short gastric arteries

  6.Hilar branches

AiraTafreeh.com
DOC TUTORIALS
LOGIN FOR SUCCESS

IVC, PORTAL VEIN, PORTOCAVAL ANASTOMOSIS

Portal vein 00:03:03

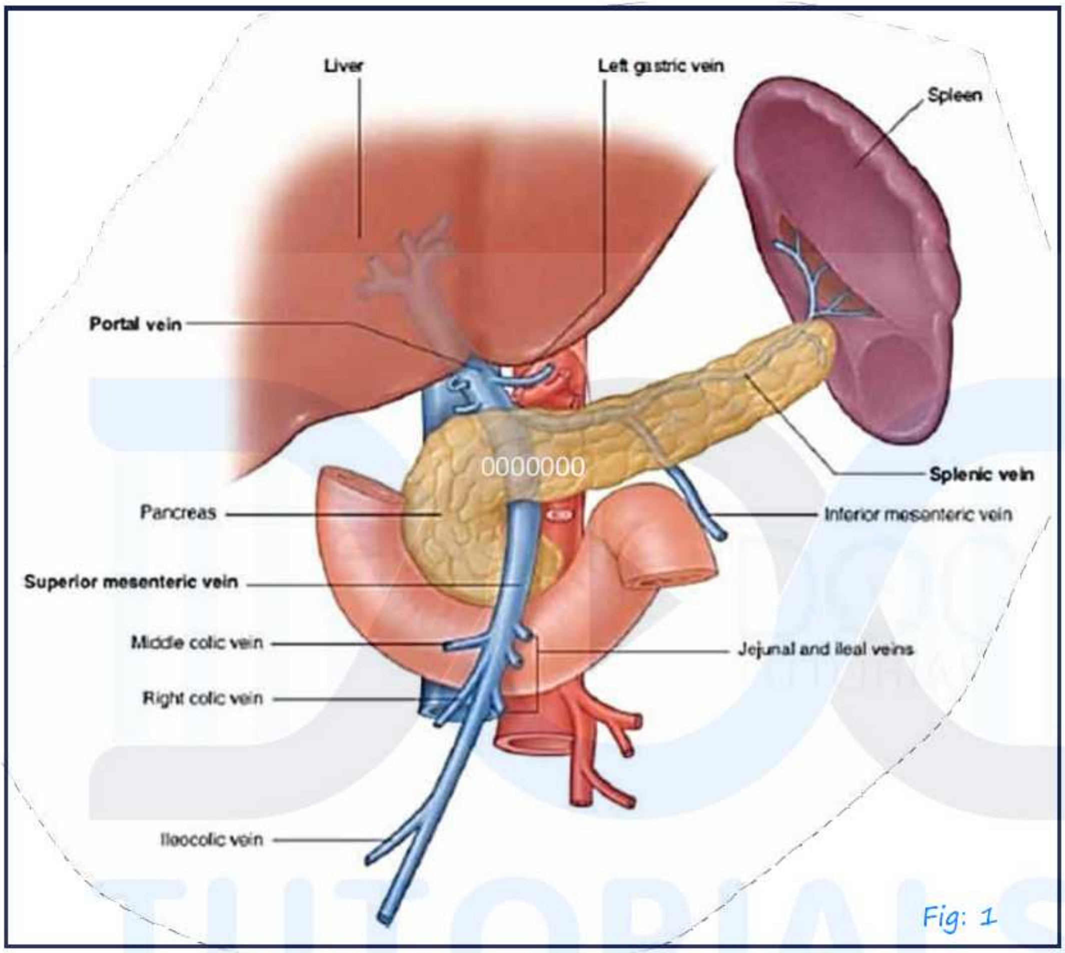

Liver
Left gastric vein
Spleen
Portal vein
Splenic vein
Pancreas
Inferior mesenteric vein
Superior mesenteric vein
Middle colic vein
Jejunal and ileal veins
Right colic vein
Ileocolic vein

Fig: 1

- Formed by splenic vein + superior mesenteric vein

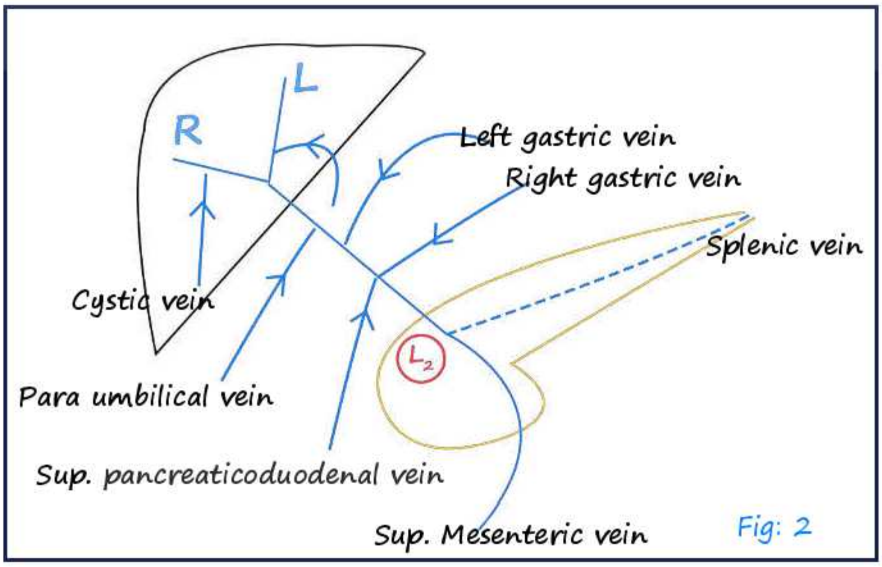

L
R
Left gastric vein
Right gastric vein
Splenic vein
Cystic vein
L_2
Para umbilical vein
Sup. pancreaticoduodenal vein
Sup. Mesenteric vein

Fig: 2

- Portal vein is formed behind the neck of the pancreas.
- Superior mesenteric vein also passes behind the neck of the pancreas.
- Portal vein is formed at the level of L_2.
- Portal vein length ≈ 8cm.
- It divides into right and left branches after it enters the liver.

Tributaries of portal vein

- Right gastric vein
- Left gastric vein
- Cystic vein
- Paraumbilical vein
- Superior pancreaticoduodenal vein

Inferior venacava (IVC) 00:07:38

- The left suprarenal vein and the left gonadal vein will drain into the left renal vein and not into the inferior venacava.
- IVC is formed behind the liver.

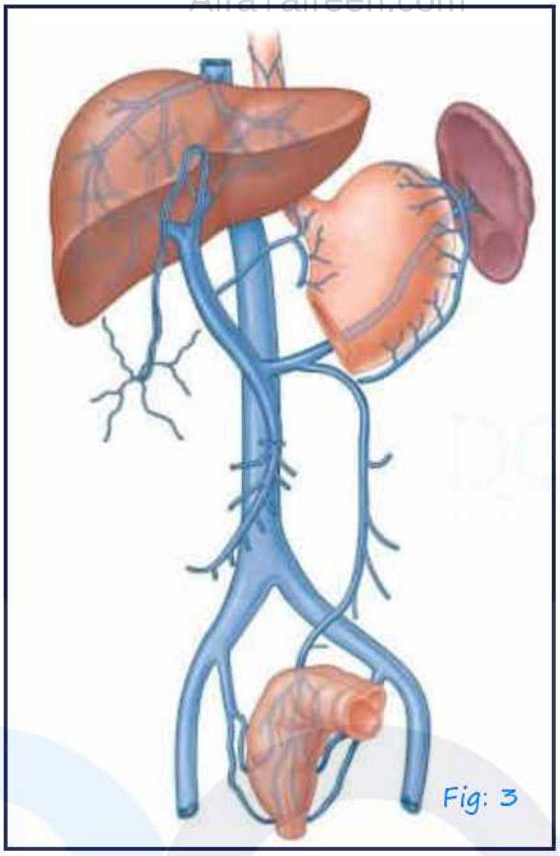


Fig: 3

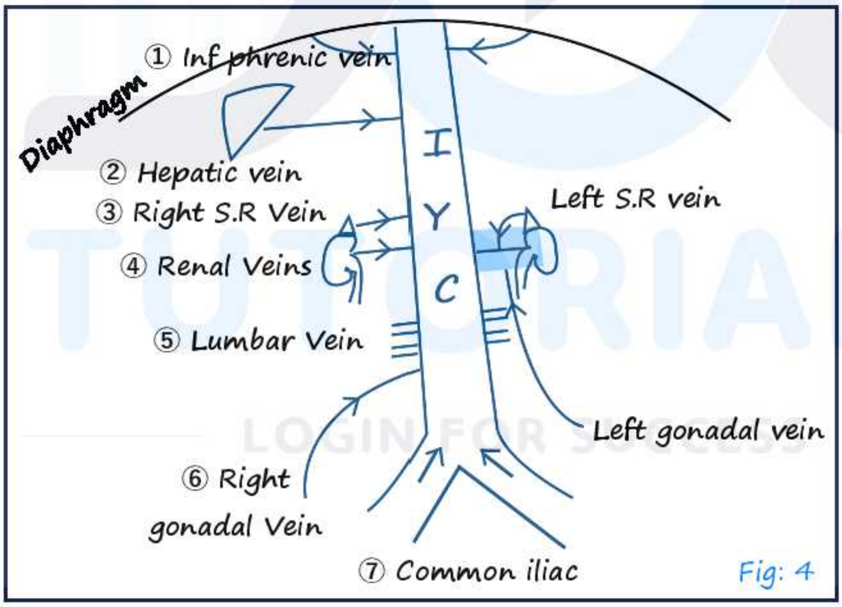

① Inf phrenic vein
Diaphragm
② Hepatic vein
③ Right S.R Vein
④ Renal Veins
⑤ Lumbar Vein
⑥ Right gonadal Vein
⑦ Common iliac
I
V
C
Left S.R vein
Left gonadal vein

Fig: 4

Portocaval anastomosis 00:13:55

Sites	Portal system	Caval system
Rectum	Superior rectal vein	Middle & inferiro rectal veins
Oesophagus	Oesophageal branches of left gastric vein	Oesophageal branches of accessory hemiazygous vein
Umbilicus	Paracumbilicla vein	Superficial veins of anterior abdominal wall

Clinical features

- Haemorrhoids
- Oesphageal varices
- Caput medusae

PERITONEUM

Peritoneum 00:01:05

Transverse section

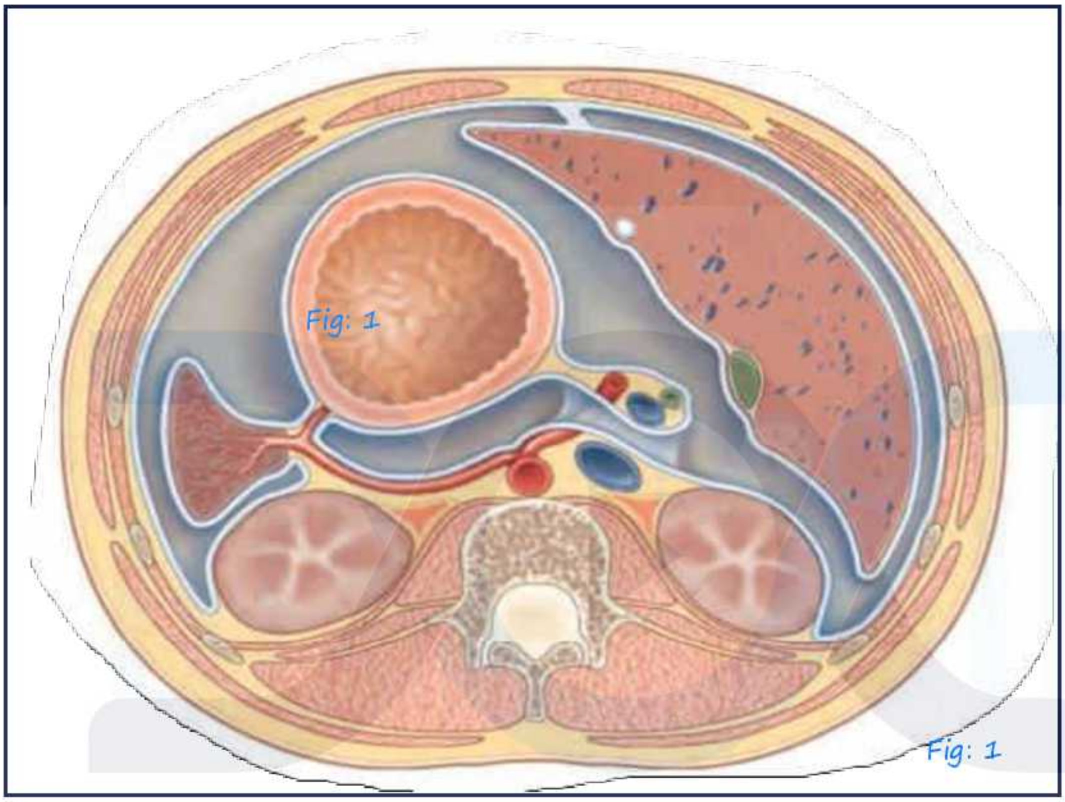


Fig: 1

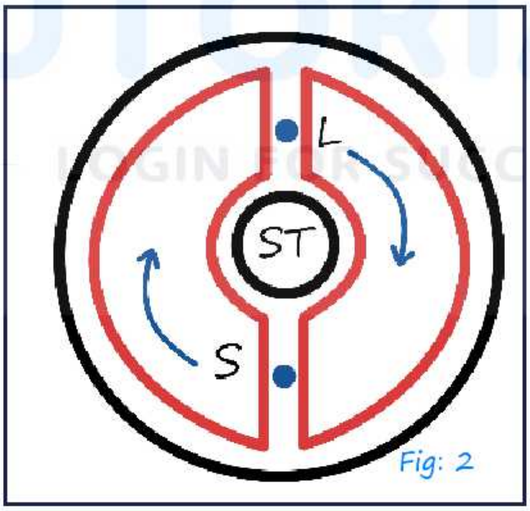


Fig: 2

- Mesoderm forms the peritoneum

Peritoneum

Visceral
- Covers the organs

Parietal
- Present outside

- Double layer of peritoneum → mesentery → connects the parietal and visceral peritoneum
- Spleen develops from the dorsal mesentery (dorsal mesogastrium); liver from the ventral mesentery

↓

Foregut rotates 90° in clock-wise direction

Foregut

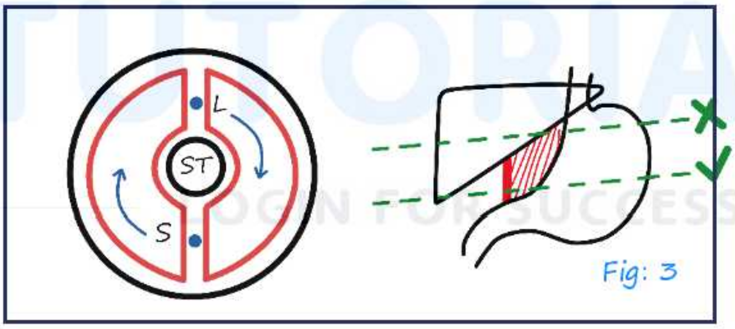
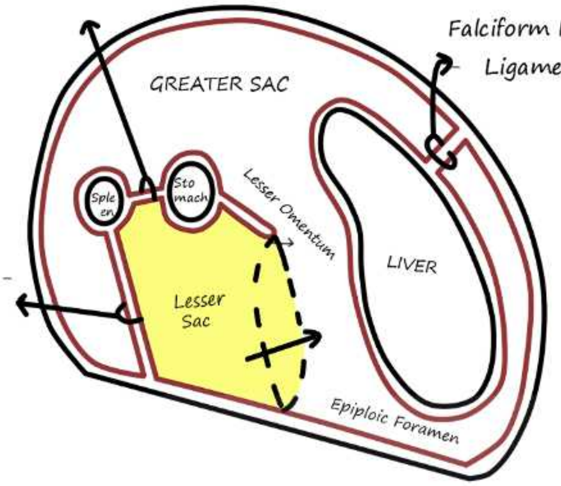


Fig: 3

DOC TUTORIALS LOGIN FOR SUCCESS

- C – Caudate lobe of liver
- D_1 – first part of duodenum


GREATER SAC
Sple en
Sto mach
Lesser Omentum
LIVER
Lesser Sac
Epiploic Foramen

Gastrosplenic ligament:
- Left gastroepiploic artery
- Short gastric arteries.

Falciform ligament:
- Ligamentum Teres

Splenorenal ligament/lieno-renal ligament:
- Splenic artery
- Tail of pancreas.

Fig: 4

Lesser omentum

Free margin	Attached part
- Portal	- Right Gastric artery
- Proper hepatic artery	- Left gastric artery
- Bile duct	

- The greater sac and lesser sac are connected by an epiploic foramen of Winslow/ omental foramen
- Epiploic foramen is behind the free margin of lesser omentum/ omental bursa

Epiploic foramen/ foramen of Winslow/ omental foramen 00:24:43

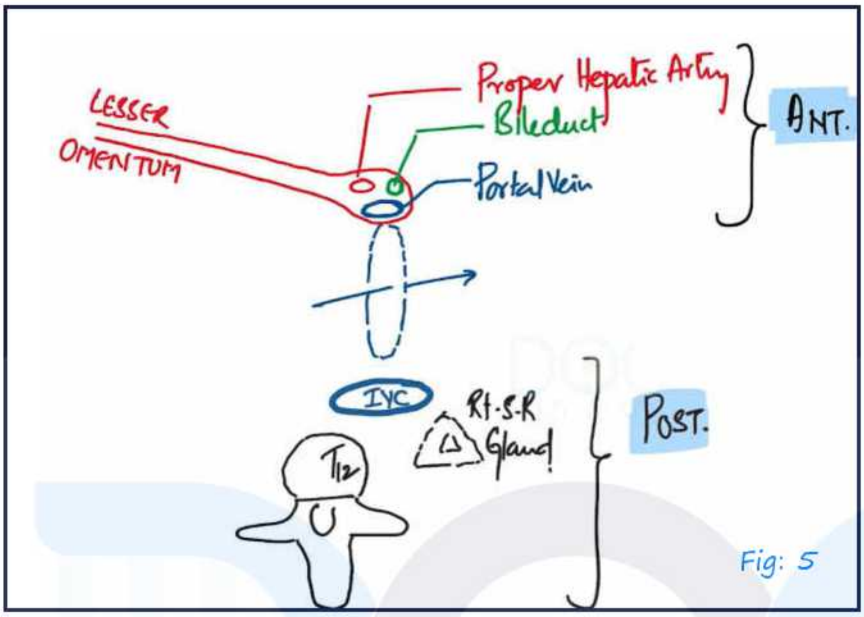

LESSER OMENTUM
Proper Hepatic Artery
Bileduct
Portal Vein
ANT.
IVC
Rt. S.R Gland
T12
POST.

Fig: 5

- Superiorly: - Caudate lobe of the liver
- Inferiorly: - First part of duodenum
- Posteriorly: - Right suprarenal gland, inferior venacava and body of T_{12}
- Anteriorly: - Portal vein (posteriorly), bile duct (right anterior); PHA (left anterior)

DOC TUTORIALS
LOGIN FOR SUCCESS

Sagittal section 00:30:36

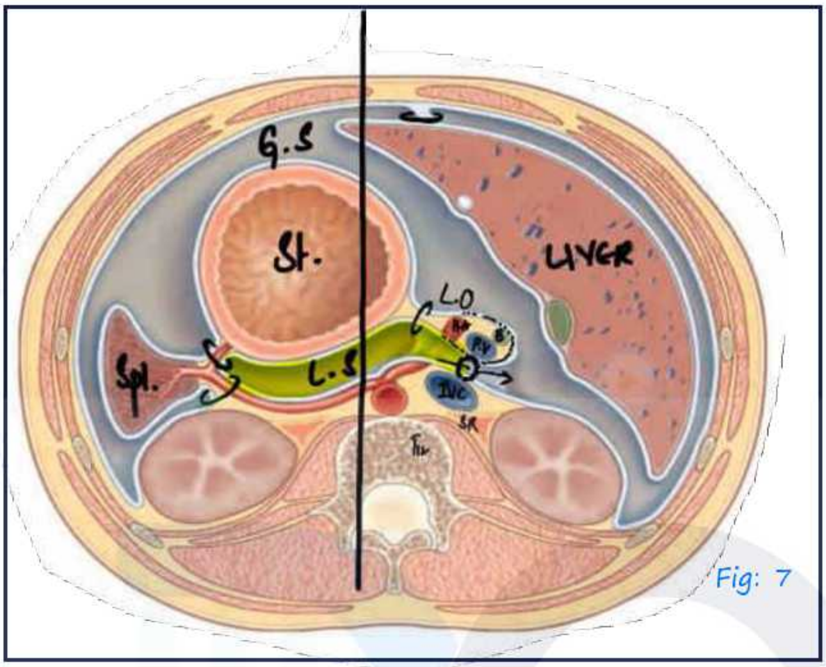

G.S
St.
LIVER
L.O
HA
B
PV
Spl.
L.S
IVC
SR
T12

Fig: 7

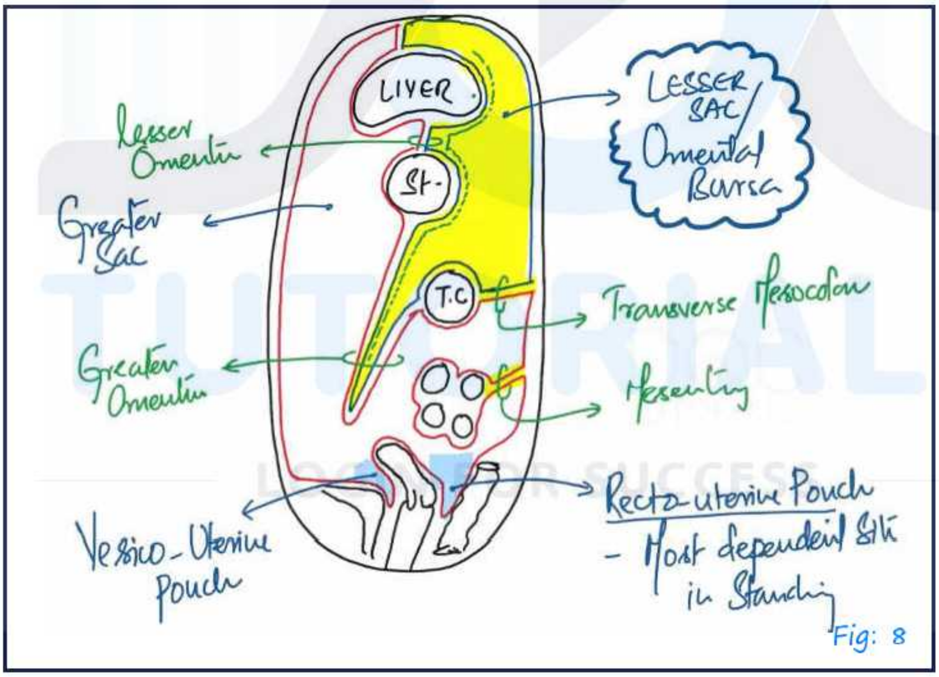

LIVER
St.
T.C
Lesser Omentum
Greater Sac
Greater Omentum
Vesico-Uterine Pouch
LESSER SAC/ Omental Bursa
Transverse Mesocolon
Mesentery
Recto-uterine Pouch
- Most dependent site in Standing

Fig: 8

- Right subhepatic space/ hepatorenal pouch of Morrison
  - Most dependent site in supine position

Relations of lesser sac 00:40:31

Anteriorly	Posteriorly
- Liver - Lesser omentum - Stomach (posterior surface) - 1st & 2nd layers of greater omentum	(Stomach bed relations except spleen): - Transverse mesocolon - Diaphragm (left crus) - Splenic artery - Left suprarenal gland - Left kidney - Splenic flexure of colon - Pancreas – 3rd & 4th layer greater omentum

AfraTafreen.com

DOC TUTORIALS
LOGIN FOR SUCCESS

Root of mesentery 00:48:54

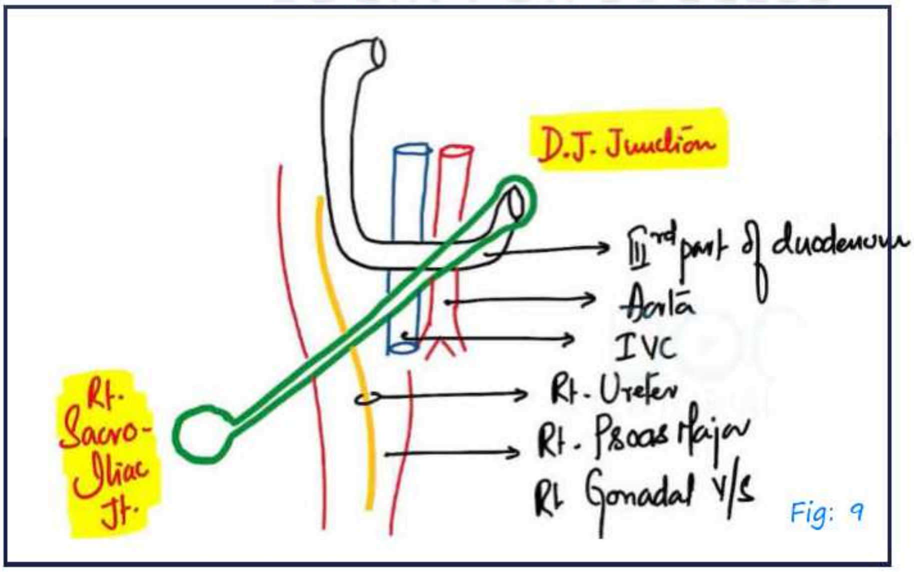

D.J. Junction
III rd part of duodenum
Aorta
IVC
Rt. Ureter
Rt. Psoas Major
Rt Gonadal V/S
Rt. Sacro-Iliac Jt.

Fig: 9

Contents

- Superior mesenteric artery
- Superior mesenteric vein
  - Root of mesentery extends from the duodenojejunal junction to the right sacro-iliac joint
  - Root of the mesentery crosses: -

1.Third pat of duodenum

2.Aorta

3.Inferior venacava

4.Right ureter

5.Right psoas major

6.Right gonadal vessels

SUPERIOR MESENTERIC ARTERY, INFERIOR MESENTERIC ARTERY

Superior Mesenteric Artery 00:00:12

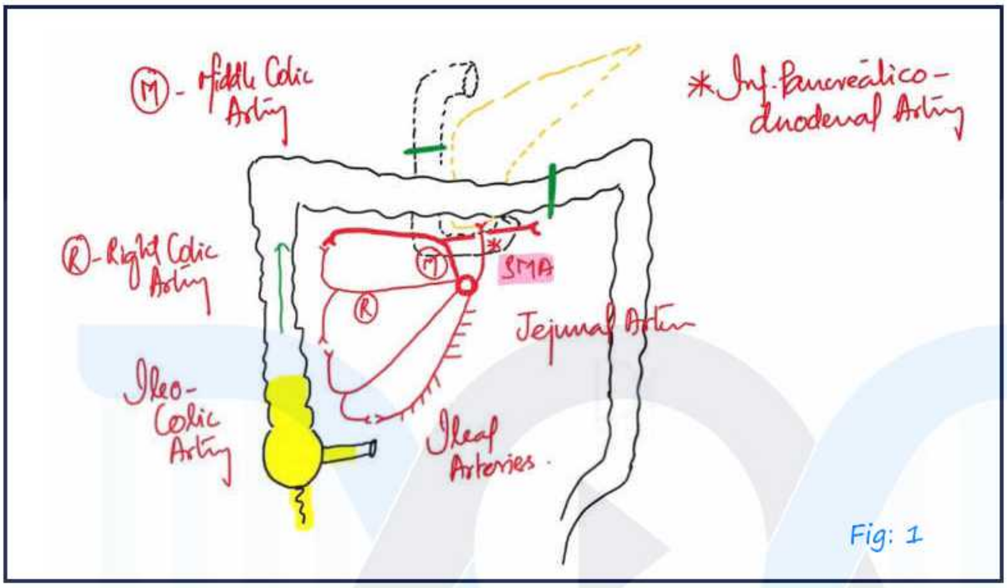

Ⓜ - Middle Colic Artery
* Inf. Pancreatico-duodenal Artery
Ⓡ - Right Colic Artery
Ⓜ
*
SMA
Ⓡ
Jejunal Artery
Ileo-Colic Artery
Ileal Arteries.

Fig: 1

1. Inferior pancreaticoduodenal artery
2. Jejunal arteries
3. Ileal arteries
4. Ileocolic artery
5. Right colic artery → Ascending colon
6. Middle colic artery

AlfaTahreen.com
DOC TUTORIALS
LOGIN FOR SUCCESS

Inferior Mesenteric Artery 00:07:58

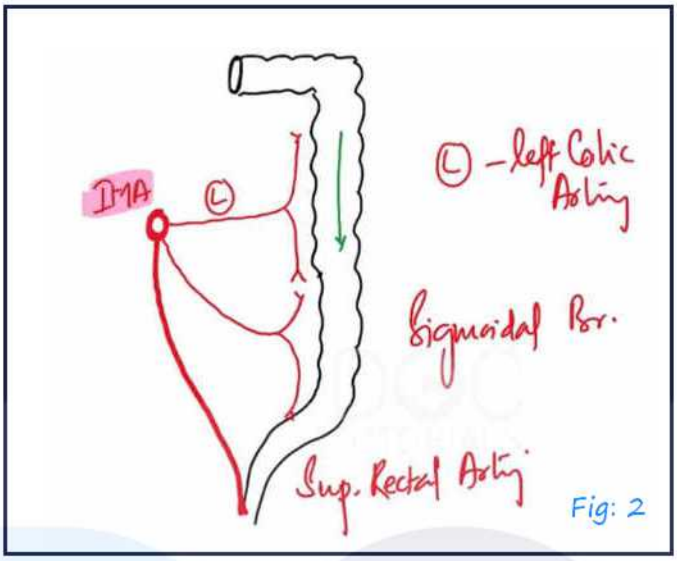

IMA
L
L – Left Colic Artery
Sigmoidal Br.
Sup. Rectal Artery

Fig: 2

1. Left colic artery
2. Sigmoidal artery
3. Superior rectal artery
   - Inferior mesenteric artery itself continues as the superior rectal artery

DOC TUTORIALS LOGIN FOR SUCCESS

Marginal artery of Drummond 00:10:13

- ICA + RCA +MCA + LCA Sigmoidal artery

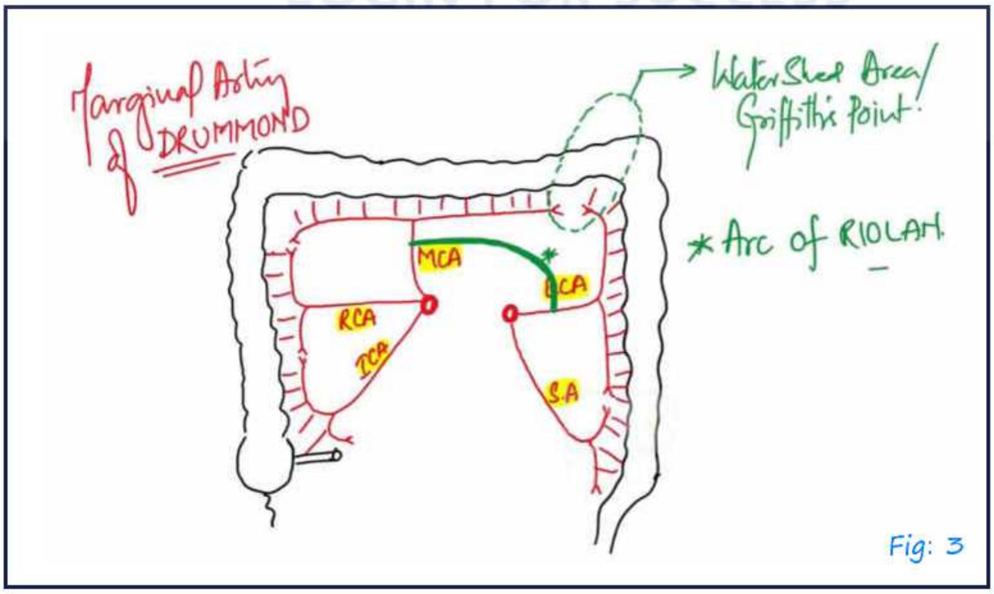

Marginal Artery of DRUMMOND
Water Shed Area/ Griffith's Point!
* Arc of RIOLAN.
MCA
LCA
RCA
ICA
S.A

Fig: 3

- Watershed area/ Griffith's point → Blood supply is compromised as anastomosis is not properly formed
- ARC of RIOLAN → formed between the middle colic artery and left colic artery → additional arteriolar anastomosis

LIVER, KIDNEY

Liver 00:00:10

Anterior surface

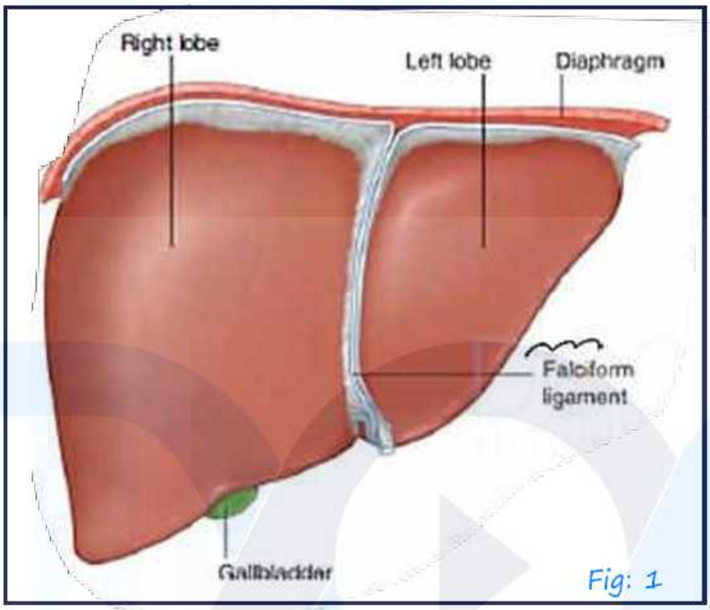

Right lobe
Left lobe
Diaphragm
Falciform ligament
Gallbladder

Fig: 1

DOC TUTORIALS LOGIN TO SUCCESS

Posterior surface

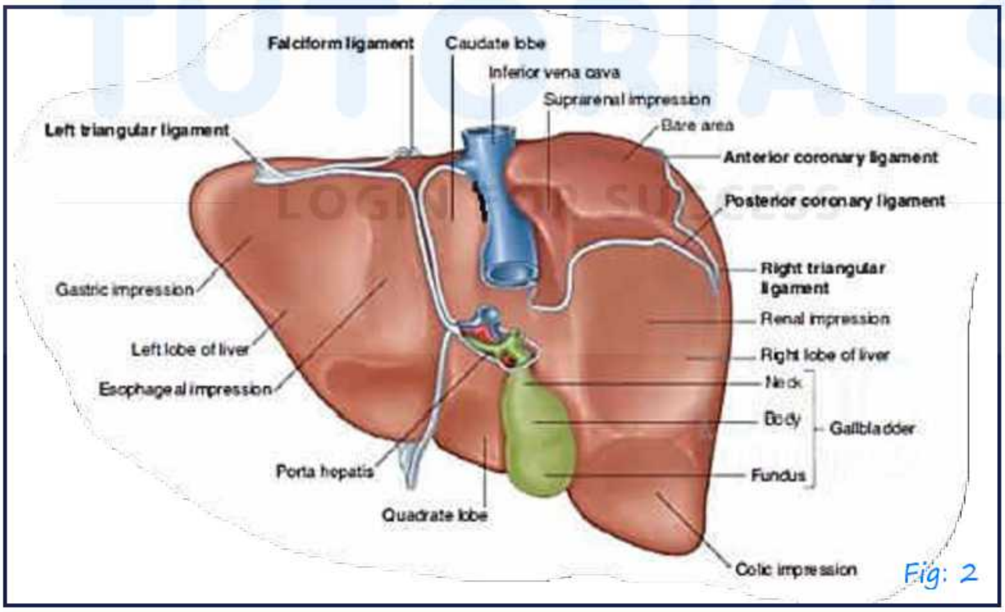

Falciform ligament
Caudate lobe
Inferior vena cava
Suprarenal impression
Bare area
Left triangular ligament
Anterior coronary ligament
Posterior coronary ligament
Right triangular ligament
Gastric impression
Renal impression
Left lobe of liver
Right lobe of liver
Esophageal impression
Neck
Body
Gallbladder
Fundus
Porta hepatis
Quadrate lobe
Colic impression

Fig: 2

Blood supply 00:06:10

- Proper hepatic artery (20-30%)
- Portal vein (70-80%)

Venous drainage

- Hepatic veins → Inferior venacava

Kidney 00:08:17

Posterior surface relations

- Left kidney

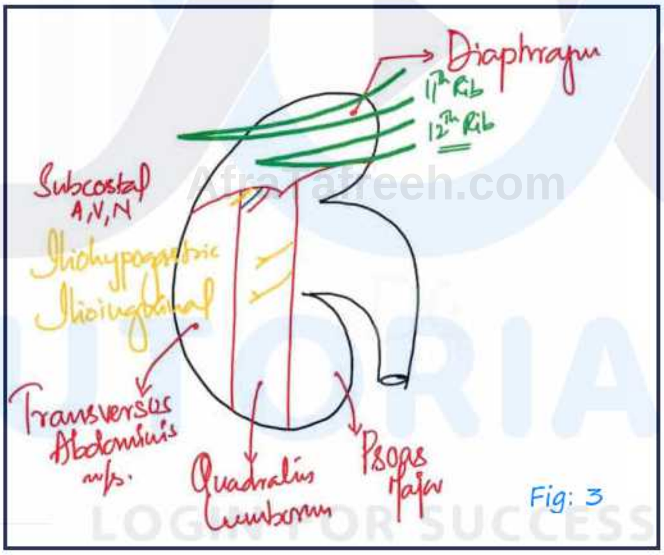

Diaphragm
11th Rib
12th Rib
Subcostal A,V,N
Iliohypogastric
Ilioinguinal
Transversus Abdominis m/s.
Quadratus Lumborum
Psoas Major

Fig: 3

DX TUTORIALS
LOGIN FOR SUCCESS

- Left kidney is related to both 11th & 12th ribs
- Right kidney is only related to the 12th rib

Anterior surface relations

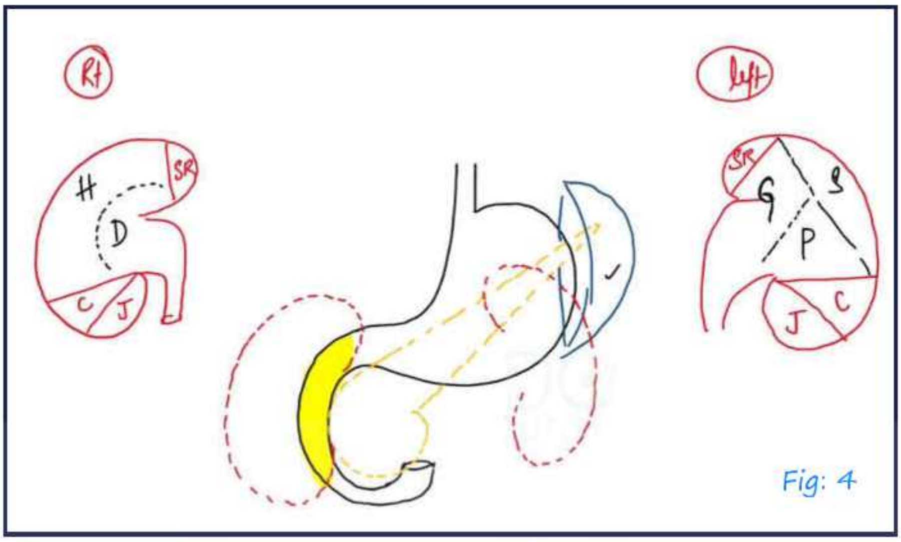


Fig: 4

- The upper poles of both kidneys is related to the suprarenal gland.
- The lower part of both the kidneys is related to the jejunum and colon.
- Right kidney relations
  - Hepatic area
  - Duodenal area
- Left kidney relations
  - Gastric area
  - Pancreatic area
  - Splenic area
- Blood supply
  - Renal artery
  - Renal vein

DOT TUTORIALS LOGIN FOR SUCCESS

BRACHIAL PLEXUS AND ITS CLINICAL CORRELATION

Brachial Plexus – Network of Nerves 00:00:33

- Origin: Ventral rami of C_5 to T_1
- 5 parts:
  i. Roots
  ii. Trunks
  iii. Divisions
  iv. Cords
  v. Branches
- Latissimus dorsi → CLIMBER'S MUSCLE
  → BROADEST MUSCLE
- Radial nerve → largest branch of brachial plexus
- Middle trunk and lower trunk do not give branches only the upper trunk gives branches – 2
  i. Suprascapular nerve
  ii. Nerve to subclavius
- Roots give out 2 branches:
  i. Dorsal scapular nerve (from ventral rami of C_5)
  ii. Long thoracic nerve/nerve to serratus anterior/nerve of bell (from C_5, C_6 and C_7)

AiraTaifeen.com
TUTORIALS
LOGIN FOR SUCCESS

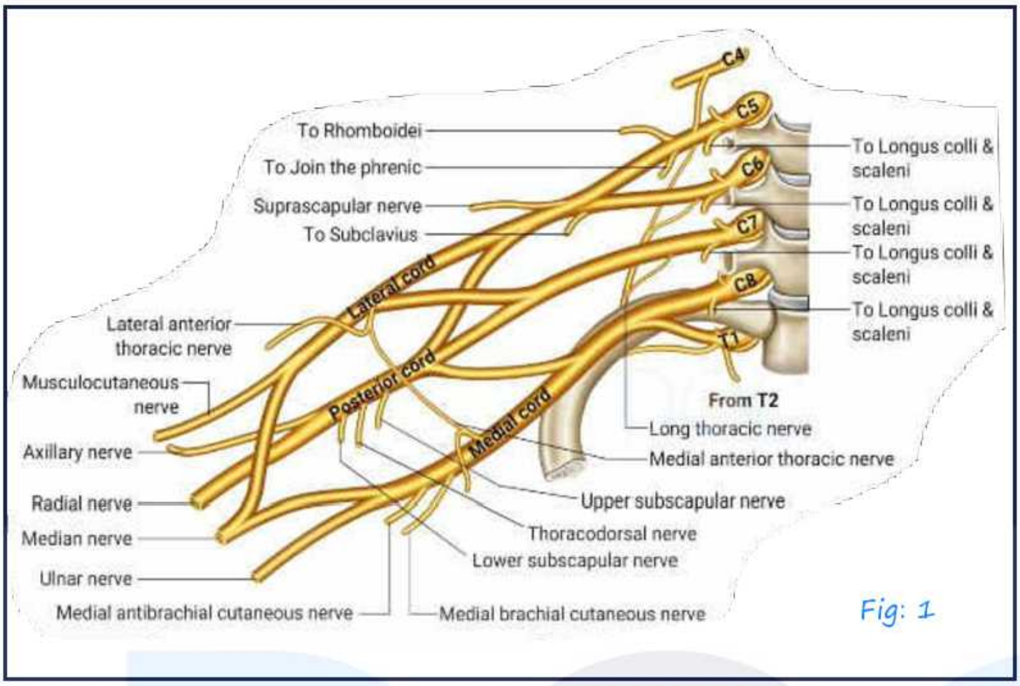
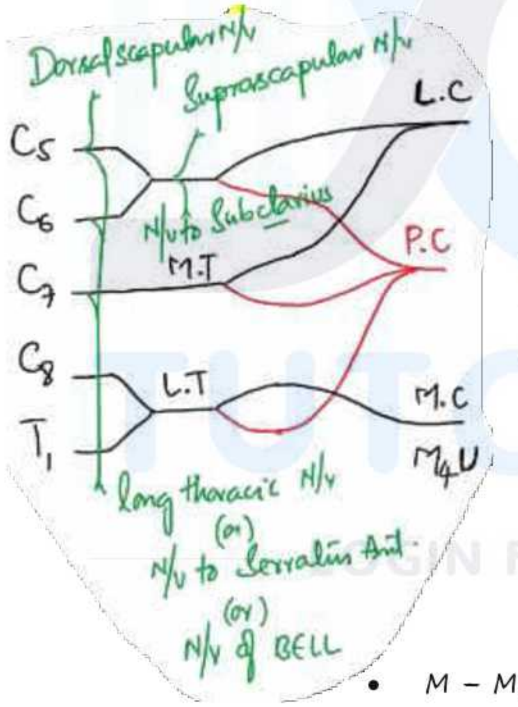

C4
C5
C6
C7
C8
T1
To Rhomboidei
To Join the phrenic
Suprascapular nerve
To Subclavius
Lateral cord
Lateral anterior thoracic nerve
Musculocutaneous nerve
Axillary nerve
Posterior cord
Radial nerve
Median nerve
Ulnar nerve
Medial cord
Medial antibrachial cutaneous nerve
Medial brachial cutaneous nerve
Lower subscapular nerve
Thoracodorsal nerve
Upper subscapular nerve
Medial anterior thoracic nerve
Long thoracic nerve
From T2
To Longus colli & scaleni
To Longus colli & scaleni
To Longus colli & scaleni
To Longus colli & scaleni

Fig: 1


Dorsal scapular N/v
Suprascapular N/v
L.C
C5
C6
N/v to Subclavius
C7
M.T
P.C
C8
L.T
M.C
T1
M4U
long thoracic N/v
(or)
N/v to Serratus Ant.
(or)
N/v of BELL

Branches — Cords
Branches — Trunks
Branches — Roots

- L – Lateral Pectoral nerve
- M – Musculocutaneous
- L – Lateral root of median

- L – Lower subscapular nerve
- U – Upper subscapular nerve
- N – Nerve to LD
- A – Axillary nerve
- R – Radial nerve

- M – Medial pectoral nerve
- M – Medial root of median nerve
- M – Medial cutaneous nerve of arm
- M – Medial cutaneous nerve of forearm
- U – Ulnar nerve

- Serratus anterior → BOXER's muscle.

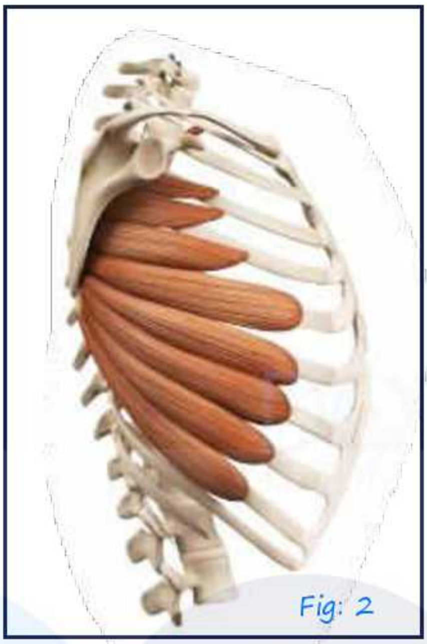


Fig: 2

- All the parts except divisions of brachial plexus give branches.

Root Values 00:21:20

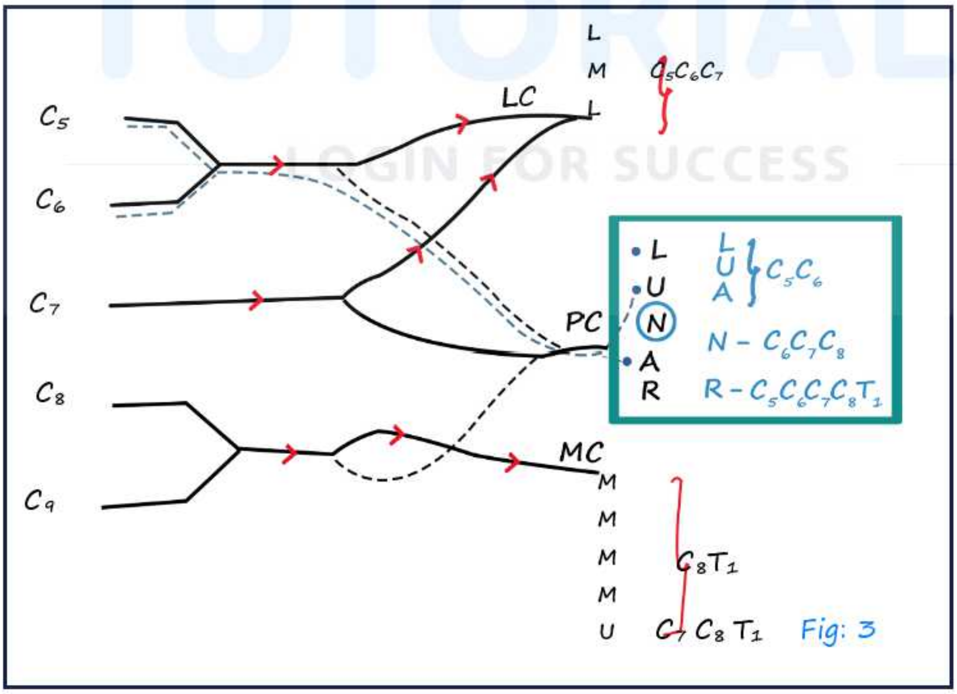

C_5
C_6
C_7
C_8
C_9
LC
PC
MC
L
M
L
$C_5C_6C_7$
• L
• U
N
• A
R
L
U
A
C_5C_6
N – $C_6C_7C_8$
R – $C_5C_6C_7C_8T_1$
M
M
M
M
M
U
C_8T_1
$C_7\,C_8\,T_1$

Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS

- Roof value of ulnar nerve – $C_7C_8T_1$
- Branch from trunk of brachial plexus:

  a. Suprascapular N

  b. N to Subclavius

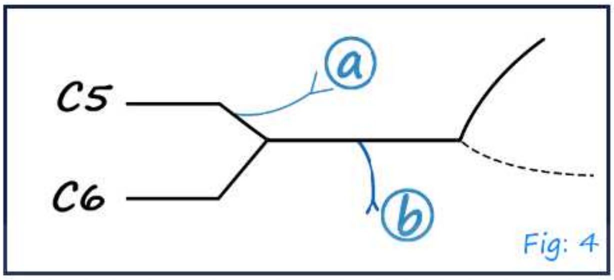


Fig: 4

- Accessory phrenic nerve is a branch of NERVE TO SUBCLAVIUS (if present)

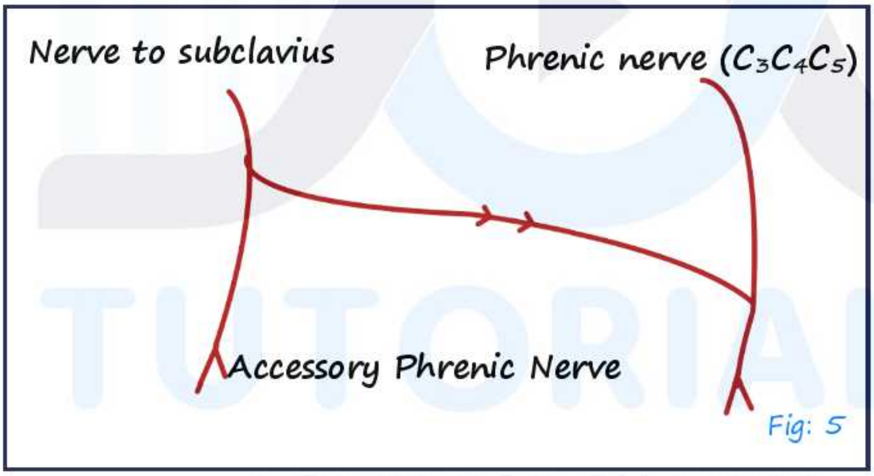

Nerve to subclavius
Phrenic nerve ($C_3C_4C_5$)
Accessory Phrenic Nerve

Fig: 5

Applied Aspect 00:32:34

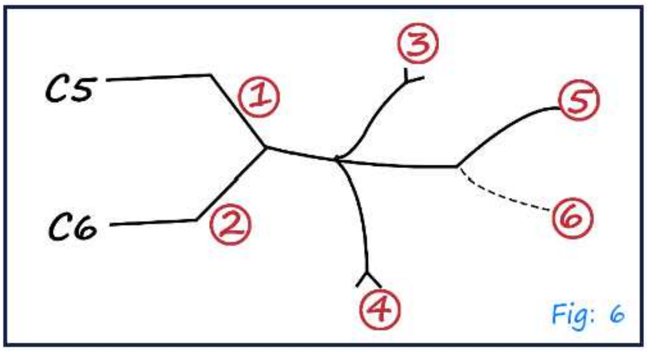
- ERB's point – Located at the upper trunk

  – 6 nerves meet at upper trunk/Erb's point:

  1. C_5
  2. C_6
  3. Suprascapular N
  4. N to subclavius

5.Anterior division

6.Posterior division



- ERB's Paralysis – Injury to upper trunk of brachial plexus
  - Nerve root involved is C_5 and C_6
  - Nerves mainly involved:
    1.Axillary N
    2.Musculocutaneous N
    3.Suprascapular N
- Cause: 1. Birth injury
  2. Fall on shoulder
- Sign of ERB's paralysis:

Arm: Adducted and medially rotated

Elbow: Extended

Fore arm: pronated

Fingers: Flexed

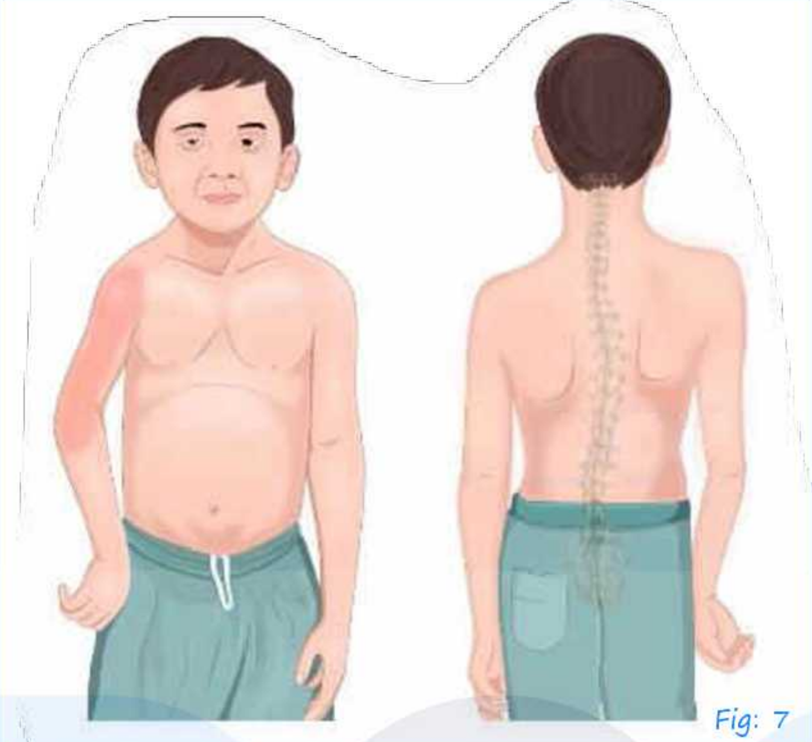


Fig: 7

- Policeman's tip hand/waiter's tip hand/porter's tip hand

- KLUMPKE'S PARALYSIS – Injury to lower trunk of brachial plexus
  - Nerve root involved: C_8T_1
  - Nerves involved: Ulnar nerve
    Median nerve
  - Sign: CLAW hand

TUTORIALS LOGIN FOR SUCCESS

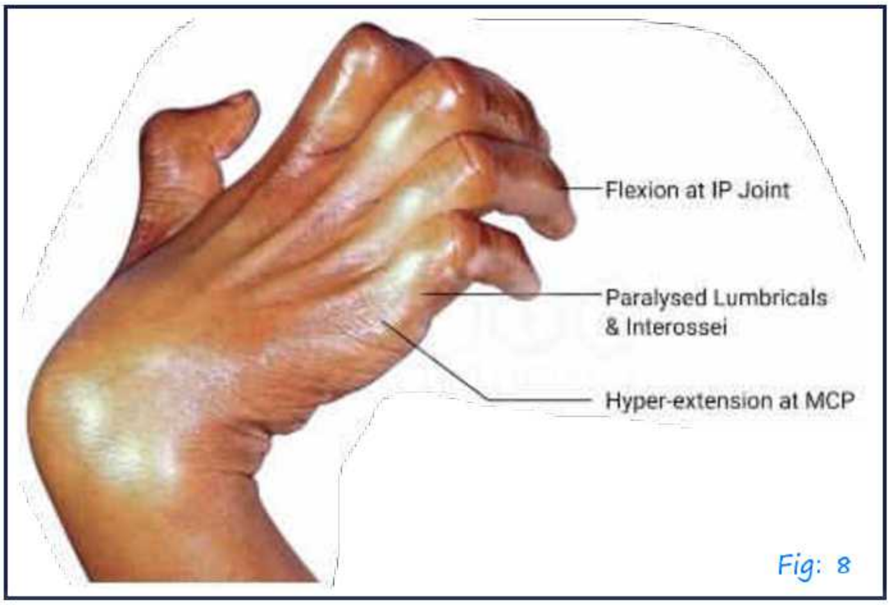

Flexion at IP Joint
Paralysed Lumbricals & Interossei
Hyper-extension at MCP

Fig: 8

- Hyperextension at metacarpophalangeal joints
- Flexion at Interphalangeal joints.

Horner's syndrome (Because T_1 is involved; not seen in ulnar and median nerve injuries)

- Klumpke's paralysis – Claw hand [ulnar N + Median N] + Horner's syndrome
- Winging of scapula – Injury to long thoracic nerve
  - Medial border of scapula becomes prominent.

DOC TUTORIALS LOGIN FOR SUCCESS

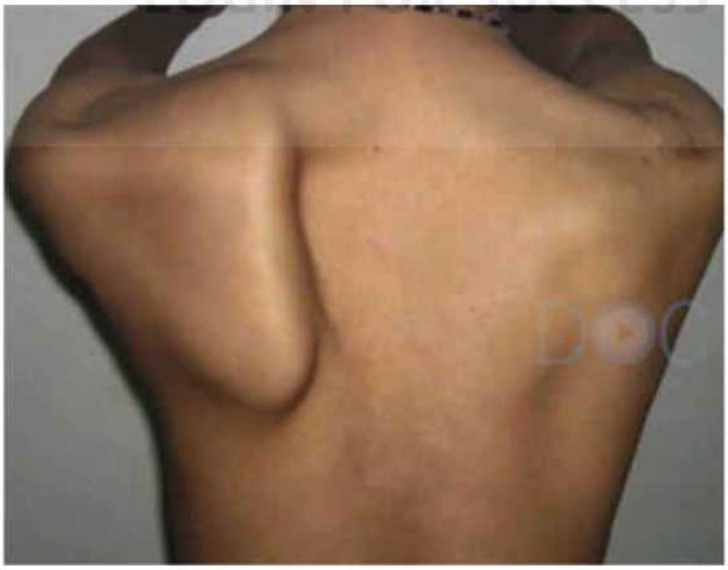


Fig: 9

MUSCLES OF ARM AND FOREARM

- ARM
  - Anterior compartment
  - Posterior compartment
- Forearm
  - Anterior compartment
  - Posterior compartment
- Hand – 20 muscles

Muscles of arm 00:01:54

Anterior compartment

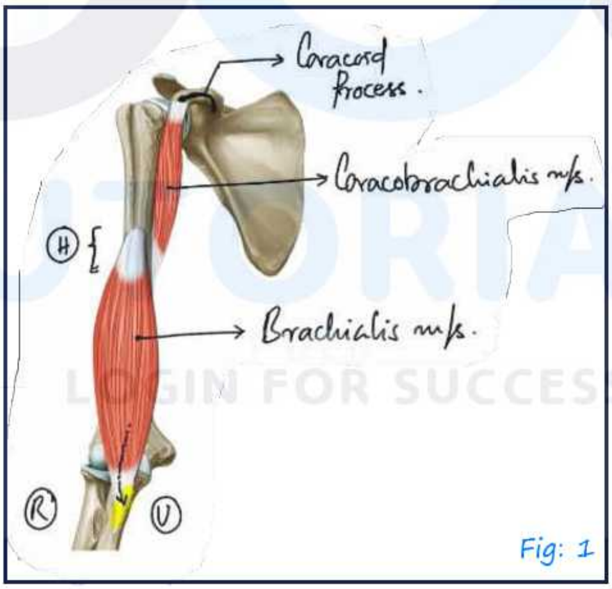

Coracoid Process.
Coracobrachialis m/s.
H
Brachialis m/s.
R
U

Fig: 1

DOC TUTORIALS
LOGIN FOR SUCCESS

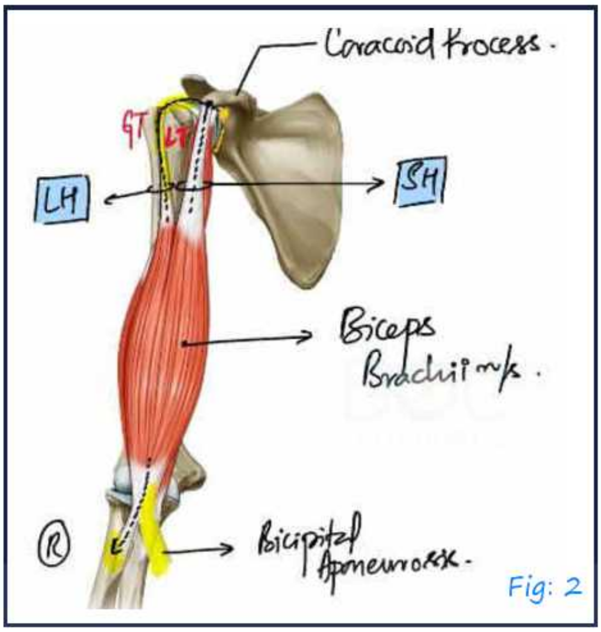

Coracoid Process.
GT
LT
LH
SH
Biceps Brachii m/s.
R
Bicipital Aponeurosis.

Fig: 2

1.Coracobrachialis

2.Biceps brachii

3.Brachialis

- Coracobrachialis
  - Origin: Coracoid process of scapula
  - Insertion: Shaft of humerus on the medial side
- Brachialis
  - Origin: Shaft of humerus
  - Insertion: Ulnar tuberosity
  - Brachialis forms the floor of the cubital fossa.
- Biceps brachii: – (2 heads)
  - Origin: Short head originates from coracoid process
  - Long head originates from supraglenoid tubercle
  - Insertion: Radial tuberosity
  - Bicipital aponeurosis → merges with the roof of cubital fossa

- Biceps tendon (long head) passes through intertubercular Sulcus
- Hence intertubercular sulcus is also known an as Bicipital groove

Posterior compartment 00:10:10

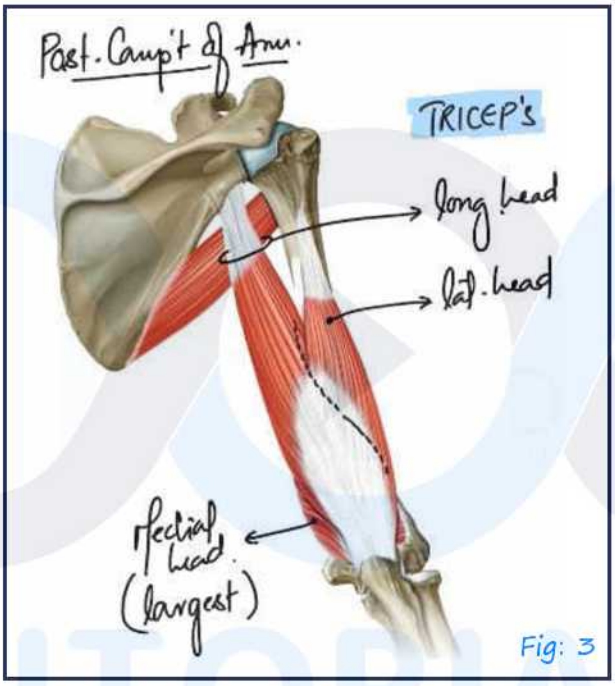

Post. Comp't of Arm.
TRICEP's
long head
lat. head
Medial head (largest)

Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS

- Triceps: - (3 heads)
- Origin:
  - Long head from infraglenoid tubercle
  - Lateral head
  - Medial head
- Medial head → largest head of triceps

Muscles of forearm 00:12:38

Anterior compartment

- Common origin: Medial epicondyle
- Cubital fossa boundries:
  - Brachioradialis – Laterally
  - Pronator teres – Medially
  - Imaginary line joining the lateral epicondyle and medial epicondyle – Base

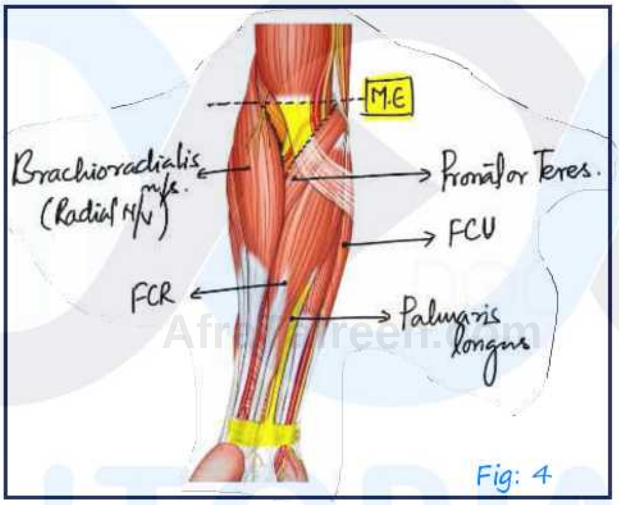

M.E
Brachioradialis m/s.
(Radial N/v)
Pronator Teres.
FCU
FCR
Palmaris longus

Fig: 4

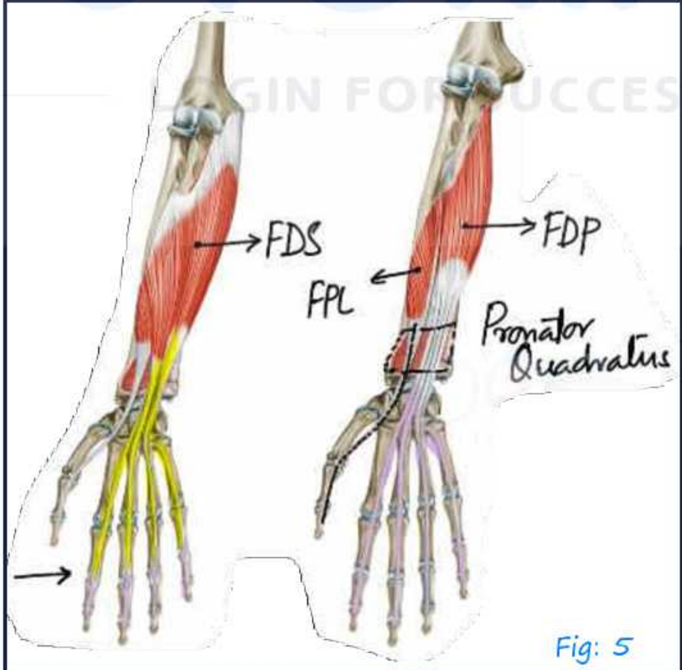

FDS
FDP
FPL
Pronator Quadratus

Fig: 5

DOC TUTORIALS
LOGIN FOR SUCCESS
Afreshtreen.com

Anterior compartment of Forearm

Superficial layer:

1. Pronator teres
2. Flexor carpi ulnaris
3. Flexor carpi radialis
4. Palmaris longus (Palmaris longus tendon is inserted in the flexor retinaculum)

Middle layer:

1. Flexor digitorum superficialis (its 4 tendons go into the digits)

Deep layer:

1. Flexor digitorum profundus (its 4 tendons go into the distal phalanges)
2. Flexor pollicis longus (flexion of thumb)
3. Pronator quadratus

- Brachioradialis is not a muscle of the anterior compartment of forearm → it is supplied by the radial nerve

---

Extensor compartment/ posterior compartment

00:23:38

Extensor compartment/ posterior compartment

Superficial layer:

1. Extensor carpi radialis longus
2. Extensor carpi radialis brevis
3. Extensor digitorum
4. Extensor carpi ulnaris
5. Extensor digiti minimi

Deep layer:

1. Extensor indicis
2. Abductor pollicis longus
3. Extensor pollicis brevis
4. Extensor pollicis longus

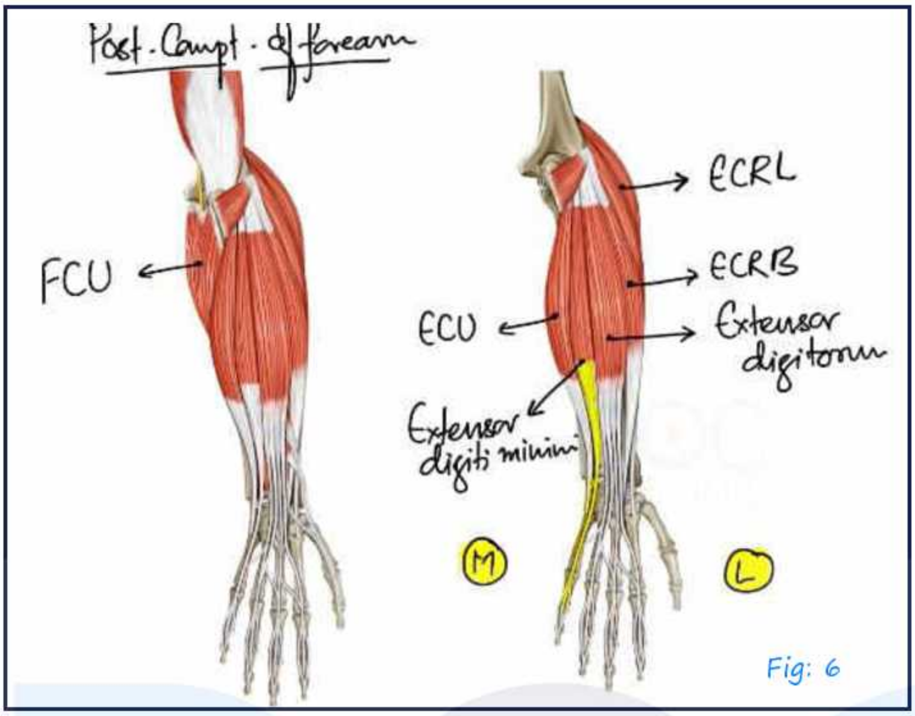

Post. Compt. of forearm
FCU
ECRL
ECRB
ECU
Extensor digitorum
Extensor digiti minimi
M
L

Fig: 6

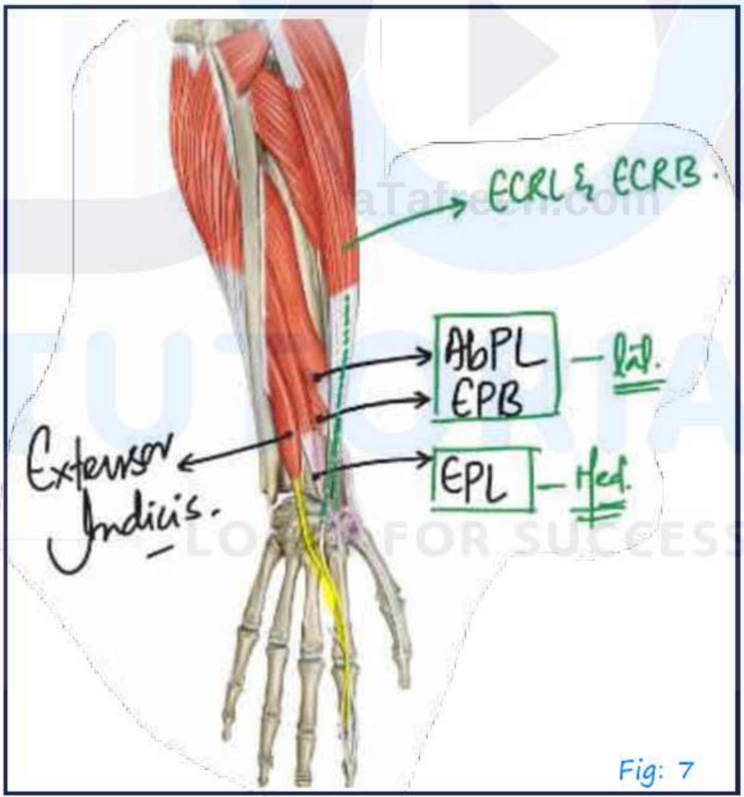

ECRL & ECRB.
AbPL
EPB
— lat.
EPL
— Med.
Extensor Indicis.

Fig: 7

Anatomical snuff box 00:31:20

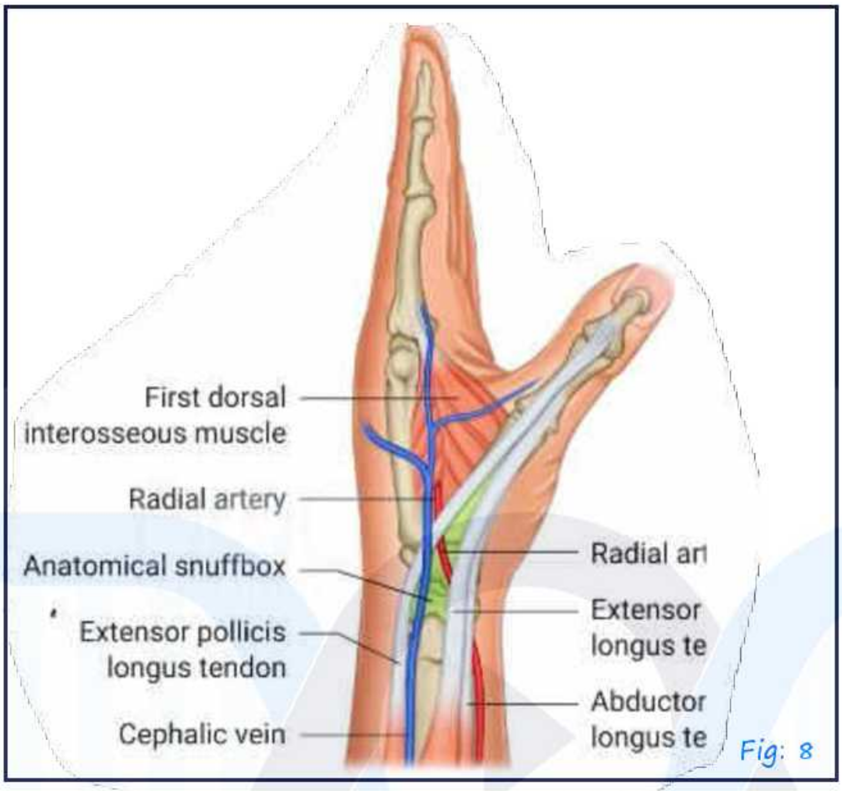

First dorsal interosseous muscle
Radial artery
Anatomical snuffbox
Extensor pollicis longus tendon
Cephalic vein
Radial art
Extensor longus te
Abductor longus te

Fig: 8

- Medially → Extensor pollicis longus
- Laterally
  - Abductor pollicis longus
  - Extensor pollicis brevis

ANATOMICAL SNUFF BOX & EXTENSOR RETINACULUM

Anatomical snuff box 00:00:23

Boundaries

- Laterally:
  - Abductor pollicis longus
  - Extensor pollicis brevis
- Medially: Extensor pollicis longus
- Floor:
  - Base of 1st metacarpal
  - Trapezium
  - Scaphoid
  - Radial styloid
  - Extensor Carpi Radialis Longus (ECRL)
  - Extensor Carpi Radialis Brevis (ECRB)
- Roof: Cephalic vein
  - Superficial branch of radial nerve
- Content: Radial Artery

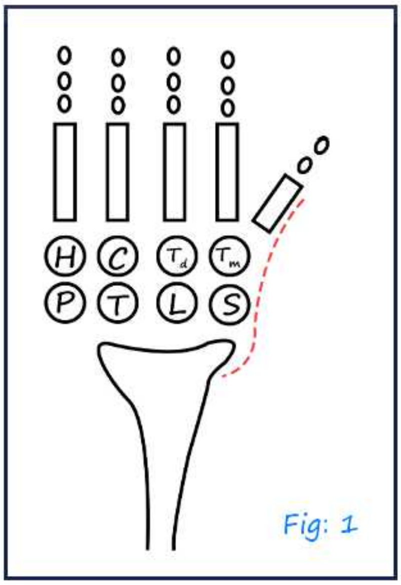


Fig: 1

Extensor retinaculum 00:07:55

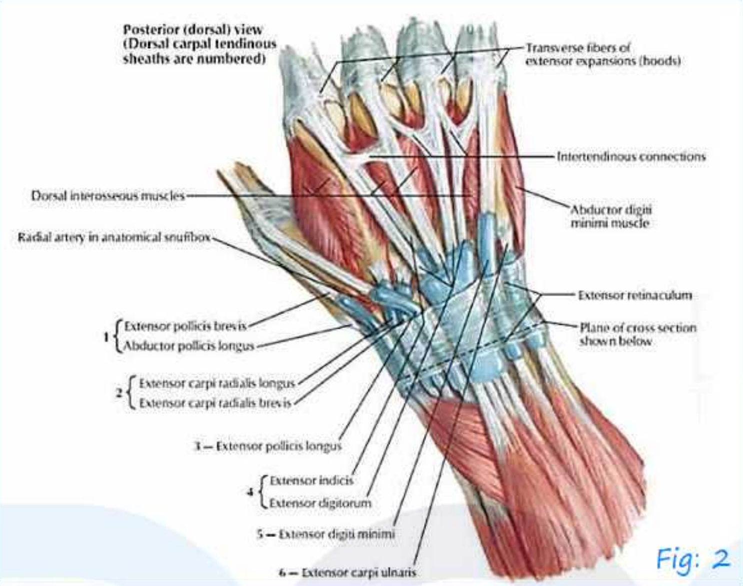

Posterior (dorsal) view
(Dorsal carpal tendinous sheaths are numbered)
Transverse fibers of extensor expansions (hoods)
Intertendinous connections
Dorsal interosseous muscles
Abductor digiti minimi muscle
Radial artery in anatomical snuffbox
Extensor retinaculum
Plane of cross section shown below
1 { Extensor pollicis brevis
Abductor pollicis longus
2 { Extensor carpi radialis longus
Extensor carpi radialis brevis
3 – Extensor pollicis longus
4 { Extensor indicis
Extensor digitorum
5 – Extensor digiti minimi
6 – Extensor carpi ulnaris

Fig: 2

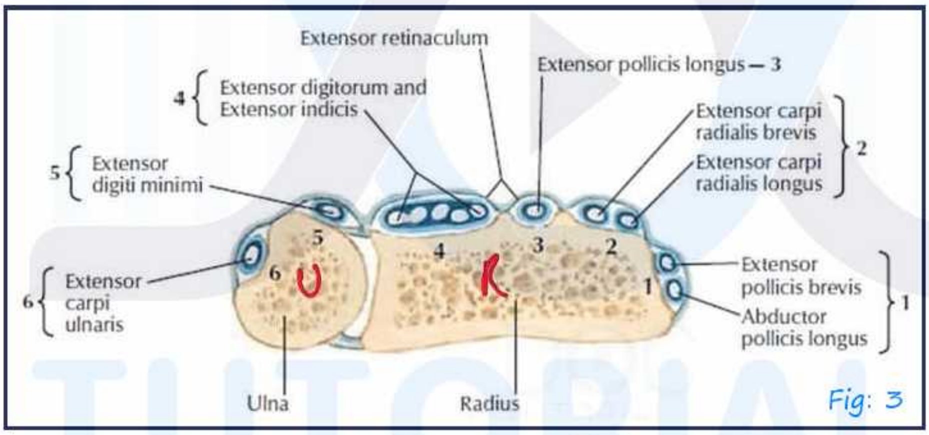

Extensor retinaculum
Extensor pollicis longus – 3
4 { Extensor digitorum and Extensor indicis
Extensor carpi radialis brevis
Extensor carpi radialis longus
} 2
5 { Extensor digiti minimi
6 { Extensor carpi ulnaris
5
6
4
3
2
1
U
R
Extensor pollicis brevis
Abductor pollicis longus
} 1
Ulna
Radius

Fig: 3

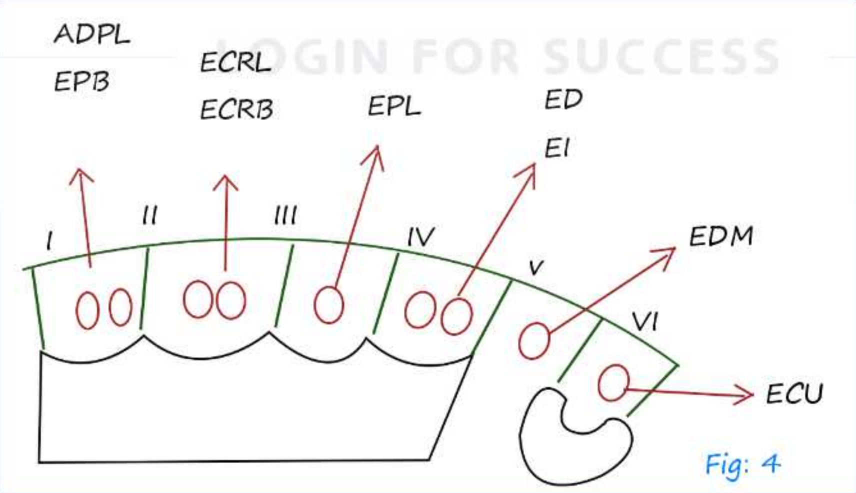

ADPL
EPB
ECRL
ECRB
EPL
ED
EI
EDM
ECU
I
II
III
IV
V
VI

Fig: 4

- I – Abductor pollicis longus; extensor pollicis brevis

DOT TUTORIALS
LOGIN FOR SUCCESS

- II – extensor carpi radialis longus; extensor carpi radialis brevis
- III – Extensor pollicis longus
- IV – Extensor digitorum; extensor indicis; posterior interosseus nerve; anterior interosseus artery
- V – Extensor digiti minimi
- VI – Extensor carpi ulnaris

MUSCLES OF HAND

Muscles of hand 00:00:33

- 4 Thenar muscles
- 4 Hypothenar muscles
- 4 Lumbricals
- 4 Palmar interossei
- 4 Dorsal interossei

Thenar muscles

- Origin: – Trapezium & scaphoid
  - – Flexor pollicis brevis
  - – Abductor pollicis brevis
  - – Opponens pollicis

  ] – **Median nerve**

  - – Adductor pollicis – **Ulnar nerve**

Hypothenar muscles: – Ulnar nerve

- Flexor digiti minimi
- Abductor digiti minimi
- Opponens digiti minimi
- Palmaris brevis
  - – Origin: Hamate & pisiform

DOC TUTORIALS LOGIN FOR SUCCESS

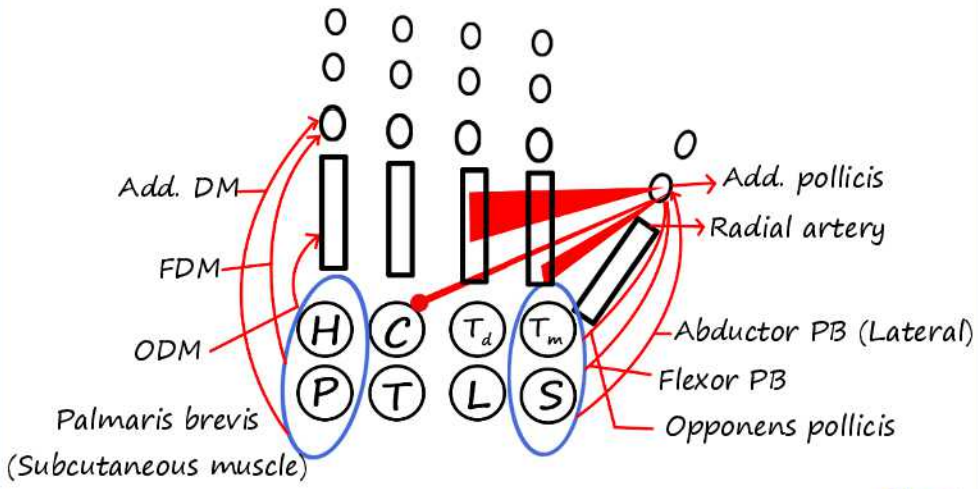

Add. DM
FDM
ODM
Palmaris brevis
(Subcutaneous muscle)
H
C
T_d
T_m
P
T
L
S
Add. pollicis
Radial artery
Abductor PB (Lateral)
Flexor PB
Opponens pollicis

Fig: 1

Fistula sign

Transverse head	Oblique head
Third metacarpal	Base of 2nd, 3rd metacarpals and capitate

- Radial artery passes in between the transverse and oblique heads of adductor pollicis → forms Deep palmar arch
- Palmaris brevis – subcutaneous muscle

DOC TUTORIALS
LOGIN FOR SUCCESS

Lumbricals 00:22:33

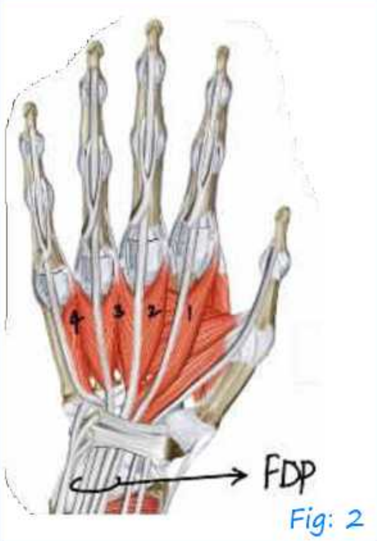


Fig: 2

- All lumbricals originate from flexor digitorum profundus (FDP) tendon
- Insertion: Extensor hood/ dorsal digital expansion
- L_1, L_3 → Unipennate – median nerve → lateral lumbricals
  - L_3, L_4 → Bipennate – ulnar nerve → medial lumbricals
- Lumbricals originate and end in a tendon
- Action: Flexion at metacarpophalangeal joints
  - Extension at interphalangeal joints

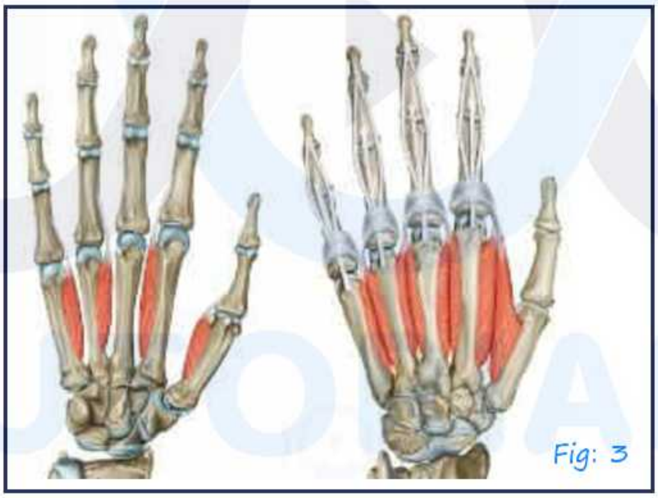


Fig: 3

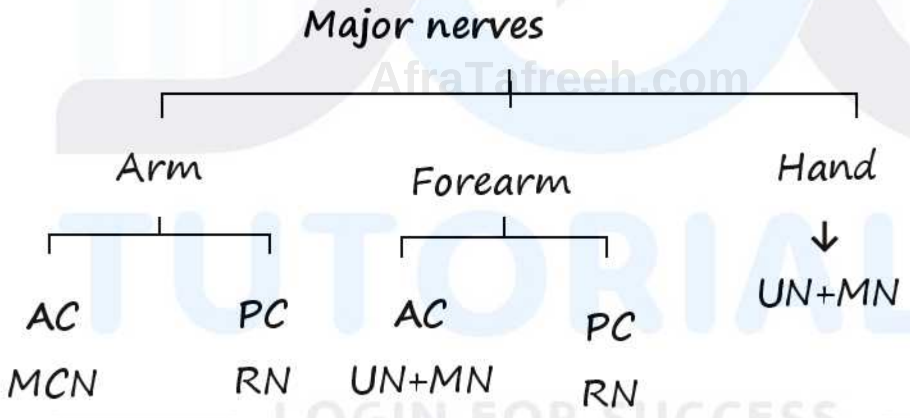
Interossei

Palmar interossei	**Dorsal interossei**
• Unipennate	• Bipinnate
• N/S: Ulnar nerve	• N/S: Ulnar nerve
• Action: Adduction of fingers (P-AD)	• Action: Abduction of fingers (D-AB)
• No palmar interossei in middle finger	• 2 dorsal interossei in middle finger
	• No dorsal interossei on thumb & little finger

MAJOR NERVES

- Arm
  - Anterior compartment (AC) ← Musculocutaneous nerve
  - Posterior compartment (PC) ← Radial nerve
- Forearm
  - Anterior compartment ← Ulnar nerve + Median nerve
  - Posterior compartment ← Radial nerve
  - Hand – Muscles of hand ← UN + MN

Major nerves 00:04:21


Major nerves
Arm
Forearm
Hand
AC
MCN
PC
RN
AC
UN+MN
PC
RN
UN+MN

- Axillary nerve → 2 muscles

  i. Deltoid

  ii. Teres minor

Musculocutaneous nerves (MCN) ($C_5C_6C_7$) 00:07:30

- **Origin:** Lateral cord of brachial plexus (LML)
- **Supplies to:** Anterior compartment of Arm: (BBC)

DOCTUTORIALS LOGIN FOR SUCCESS

  - Biceps brachii
  - Brachialis (medial part)
  - Coracobrachialis
- Sensory supply:
  - MCN continues as lateral cutaneous nerve of forearm

Note

- Musculocutaneous nerve pierces coracobrachialis and enters the arm
- Brachialis → composite/ hybrid muscle (supplies by 2 nerves)
  - Medial part – MCN
  - Lateral part – Radial nerve
- Struthers' ligament represents the third head of coracobrachialis → present only in some

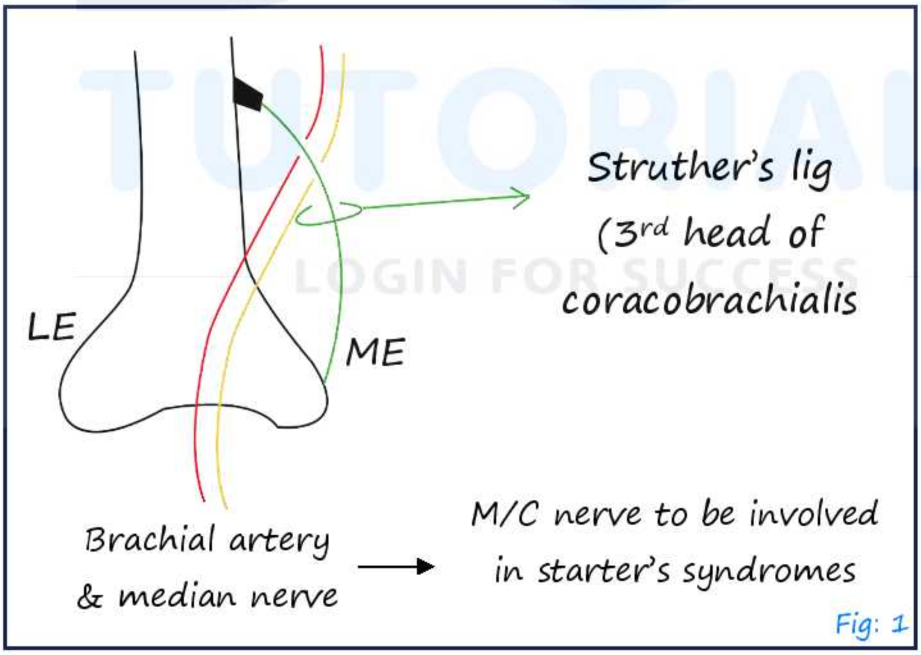

Struther's lig
(3rd head of
coracobrachialis
LE
ME
Brachial artery
& median nerve
M/C nerve to be involved
in starter's syndromes

Fig: 1

- The median nerve and brachial artery get compressed in struthers syndrome

Axillary nerves 00:22:11

- Origin: Posterior cord of brachial plexus (LUNAR)
- Supplies to:
  - Deltoid
  - Teres minor
- Sensory supply
  - Skin over upper lateral side of the arm (lower lateral side of arm → radial nerve)
- Applied aspect:
  - Regimental badge sign: loss of sensation from upper lateral side of arm due to an injury to axillary nerve.

RADIAL NERVE

Radial Nerve: (C_5 C_6 C_7 C_8 T_1) 00:00:15

- Largest branch in brachial plexus.
- Origin – Posterior cord of brachial plexus (LUNAR)
- Supplies to – Posterior compartment of arm → Triceps

  Posterior compartment of forearm → Extensors.

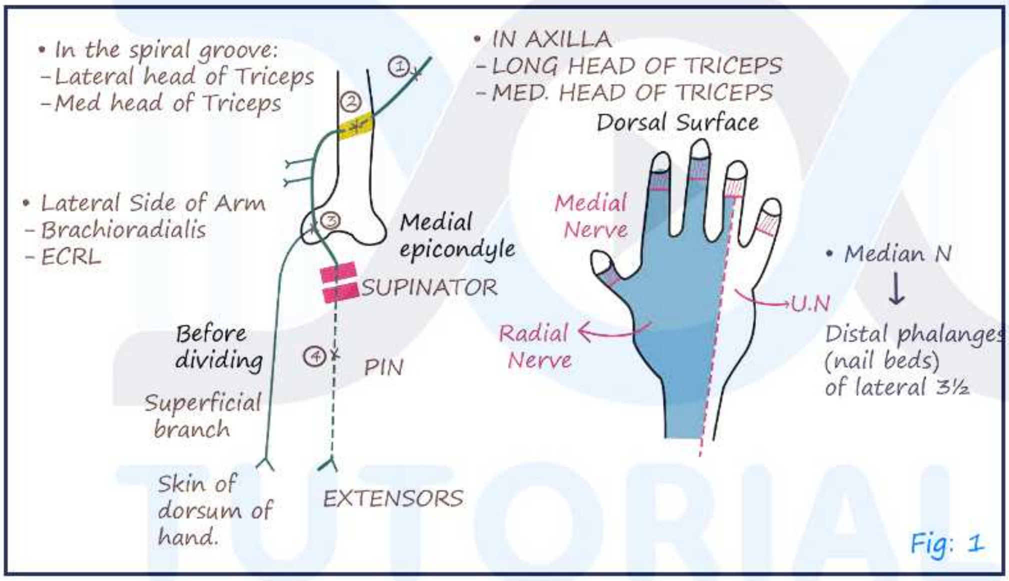

• In the spiral groove:
-Lateral head of Triceps
-Med head of Triceps
①
②
③
④
• IN AXILLA
-LONG HEAD OF TRICEPS
-MED. HEAD OF TRICEPS
Dorsal Surface
• Lateral Side of Arm
-Brachioradialis
-ECRL
Medial epicondyle
Medial Nerve
SUPINATOR
• Median N
U.N
Before dividing
PIN
Radial Nerve
Distal phalanges (nail beds) of lateral 3½
Superficial branch
Skin of dorsum of hand.
EXTENSORS

Fig: 1

- Median nerve → supplies to the Distal phalanges (nail beds) of the lateral 3 ½ digits.

Radial Nerve Injuries 00:14:02

- Radial nerve injuries
  - Higher lesion
  - Lower lesion

i. Triceps muscle (extension at elbow joint)

[loss of extension at the elbow or flexed elbow]

ii. Extensor carpi radialis longus (ECRL) (most potent extensor of the wrist joint)
[WRIST DROP]

iii. Posterior interosseous nerve (PIN) (affects extensor digitorum)
[FINGER DROP]

iv. Superficial branch → sensory loss in the dorsum of the hand

1. Higher Lesion

In Axilla
(Crutch palsy)

Signs

1. Flexed elbow/loss of extension at the elbow ∵ Triceps is involved
2. Wrist drop (+) ∵ ECRL is involved
3. Finger drop (+) ∵ PIN is involved
4. Sensory loss of the dorsum of hand ∵ superficial branch involved.

In SPIRAL GROOVE
(Saturday night palsy)

Signs

1. Weakness of extension at elbow
2. Wrist drop (+) ∵ ECRL is involved
3. Finger drop (+) ∵ PIN is involved
4. Sensory Loss (+) ∵ Sensory branch is involved

2. Lower lesion

- **Injury at lateral epicondyle**

1. No wrist drop ∵ ECRL is spared
2. Finger drop (+)
3. Sensory loss (+)

- **Injury to posterior interosseous nerve:**

1. No wrist drop
2. Finger drop (+)
3. Sensory loss (-) ∵ Superficial branch is spared

MEDIAN NERVE

Median nerve → Labourer's nerve/ eye of the hand

($C_5C_6C_7C_8T_1$) 00:00:10

- Origin
  - Lateral cord of brachial plexus
  - Medial cord of brachial plexus
- Supplies to:

  1. Arm: - No supply
  2. Forearm: - All muscles of anterior compartment of forearm except: medial 1 ½ muscle (Flexor carpi ulnaris and medial ½ of Flexor digitorum profundus)
  3. Hand: -
     - Thenar muscle except adductor pollicis
     - Lumbricals – L_1 and L_2

DOC TUTORIALS
LOGIN FOR SUCCESS

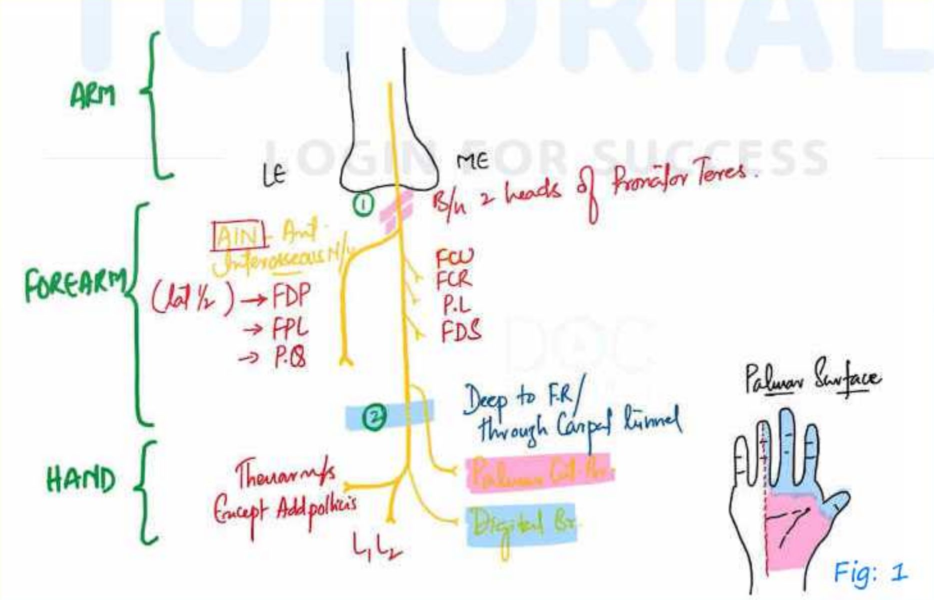

ARM
FOREARM
HAND
LE
ME
①
B/n 2 heads of Pronator Teres.
AIN Ant. Interosseous N/v
(lat ½) → FDP
→ FPL
→ P.Q
FCU
FCR
P.L
FDS
②
Deep to F.R/ through Carpal tunnel
Palmar Cut. Br.
Digital Br.
Thenar m/s Except Add pollicis
L1 L2
Palmar Surface

Fig: 1

- Median nerve enters the forearm → between the two heads of pronator teres.

- After entering the forearm, it gives out a branch → Anterior interosseous nerve
- It passes deep to the flexor retinaculum and enters the hand, through the carpal tunnel.
- Median nerve in the hand
  - Digital branch → lateral 3½ digits
  - Palmar branch → lateral 3½ palm

Median nerve injuries 00:16:57

Median nerve injuries

Higher lesion
(Near elbow)

- Pronator teres syndrome
- Supracondylar fracture of the humerus
- Struthers' syndrome

Signs: -

1. Ape-thumb deformity ⊕
2. Pointing index ⊕
3. Sensory loss of lateral 3½ hand (palm + digits)

Lower lesion
(Near wrist-carpal tunnel)

- Carpal tunnel syndrome

Signs: -

1. Ape-thumb deformity ⊕
2. Pointing index ⊖
3. Sensory loss of lateral 3½ digits only (No palmar branch involvement)

AfraTafreen.com
TUTORIALS
LOGIN FOR SUCCESS

ULNAR NERVE

Ulnar nerve 00:00:18

- Origin: Medial cord of brachial plexus (M4U)
- Supplies to: 1. Arm – no supply

  2. Forearm

  – Medial 1 ½ muscles of anterior compartment:

  1. Flexor carpi ulnaris
  2. Flexor digitorum profundus (medial half)

Note:

Flexor digitorum profundus → Composite/hybrid muscle

Medial half ↑ Ulnar nerve

Lateral half ↑ Median nerve

3. Hand (15/20): 1. Hypothenar muscles

   2. Lumbrical – L_3 – L_4

   3. All Interossei (4 palmar + 4 dorsal)

   4. Adductor policis [Graveyard of the ulnar nerve as it goes and ends there]

- Ulnar Nerve = Musician's Nerve
- It supplies 15 out of 20 muscles of the hand → Dominant nerve of hand

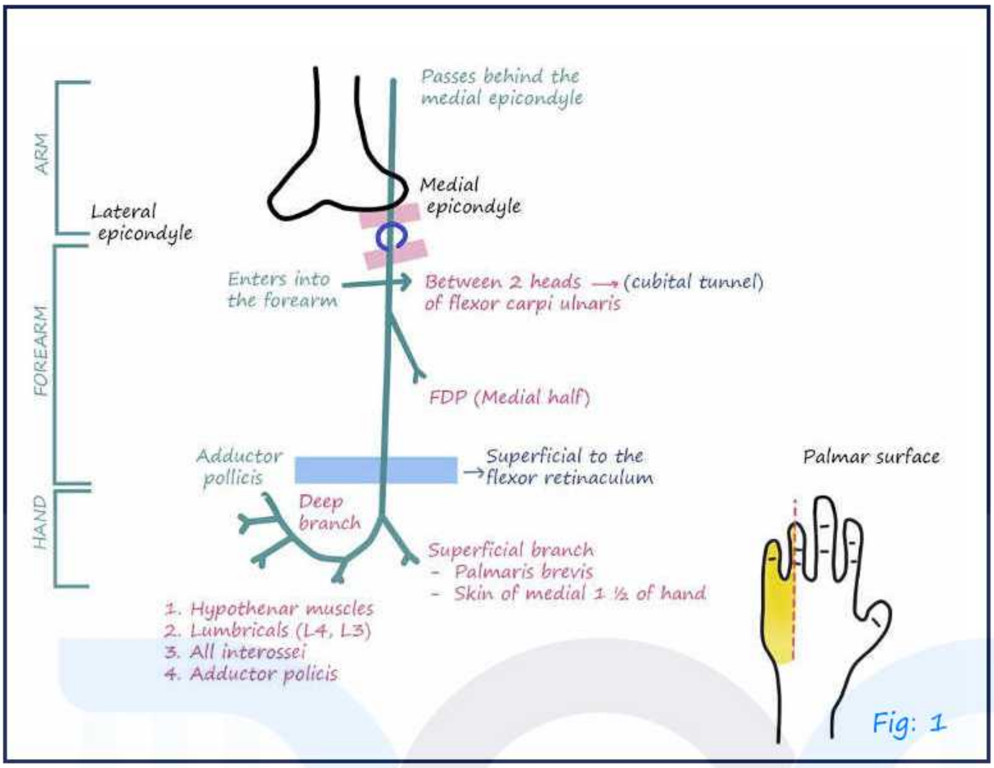

ARM
FOREARM
HAND
Passes behind the medial epicondyle
Medial epicondyle
Lateral epicondyle
Enters into the forearm
Between 2 heads → (cubital tunnel) of flexor carpi ulnaris
FDP (Medial half)
Adductor pollicis
Superficial to the → flexor retinaculum
Palmar surface
Deep branch
Superficial branch
- Palmaris brevis
- Skin of medial 1 ½ of hand
1. Hypothenar muscles
2. Lumbricals (L4, L3)
3. All interossei
4. Adductor policis

Fig: 1

- Cubital Tunnel: Ulnar nerve passes between the two heads of the flexor carpi ulnaris through the cubital tunnel.
- Cubital Tunnel Syndrome: ulnar nerve gets compressed.
- Ulnar nerve passes superficial to flexor retinaculum.

Applied Aspect 00:17:21

Ulnar Paradox

Higher lesion
[Cubital tunnel syndrome]

- Less claw [as FDP is involved]
- Cubital tunnel syndrome

Lower lesion
[Guyon's canal syndrome]

- More claw [as FDP is spared]
- Guyon's canal syndrome

PECTORAL REGION - I

Pectoral Region 00:01:00

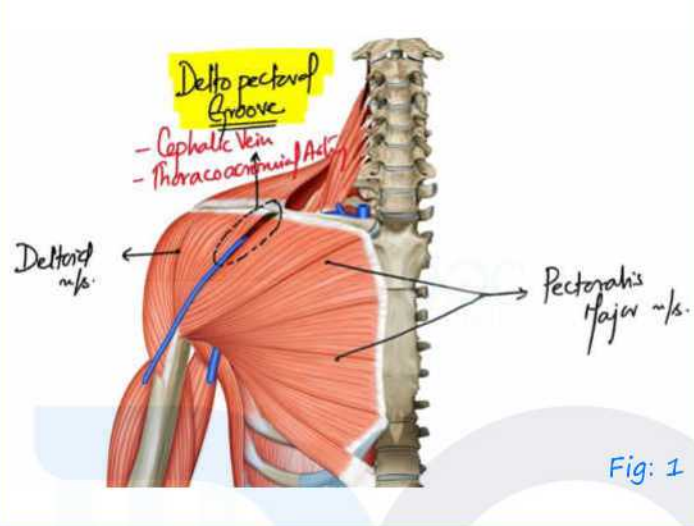

Delto pectoral Groove
- Cephalic Vein
- Thoracoacromial Artery
Deltoid m/s.
Pectoralis Major m/s.

Fig: 1

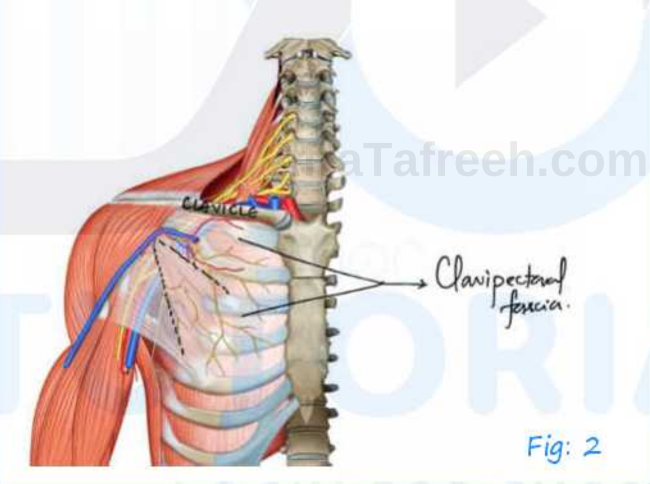

CLAVICLE
Clavipectoral fascia.

Fig: 2

DocTutorials
LOGIN FOR SUCCESS

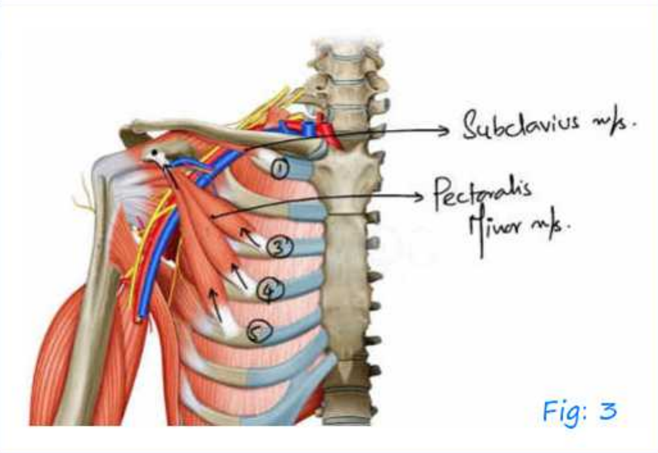

Subclavius m/s.
Pectoralis Minor m/s.
①
③
④
⑤

Fig: 3

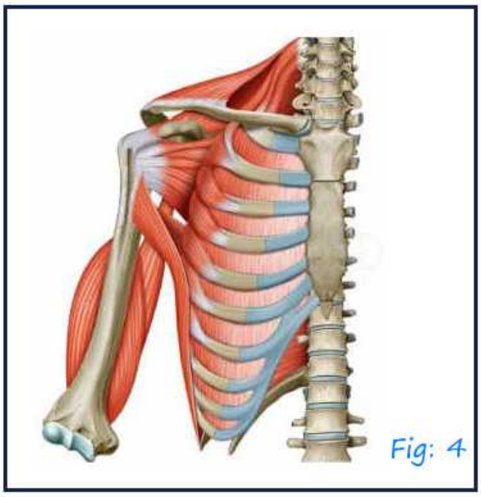


Fig: 4

Front view

- Pectoralis major is a spiral muscle
- Structures in the front view

1. Deltoid muscle
2. Pectoralis major muscle
3. Deltopectoral groove (in between deltoid and pectoralis major muscle)
   - Cephalic vein
   - Thoracoacromial trunk/ artery
4. Clavipectoral fascia (below the pectoralis major muscle)
   - Splits and encloses 2 muscles
     i. Subclavius
     ii. Pectoralis minor (origin: 3rd, 4th x 5th ribs, Insertion: coracoid process)
5. Latissimus dorsi (Broadest muscle) → Climber's muscle
6. Serratus anterior (attached to the upper 8 ribs)
   - Boxer's muscle
7. Subscapularis

TUTORIALS LOGIN FOR SUCCESS

Structures in the back-view

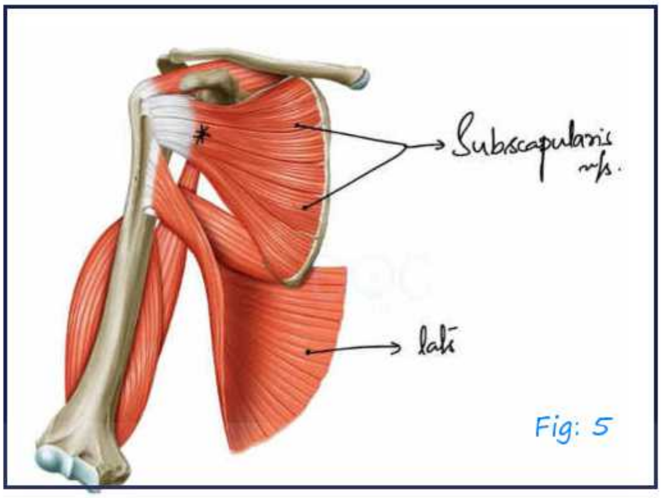

*
Subscapularis m/s.
lati

Fig: 5

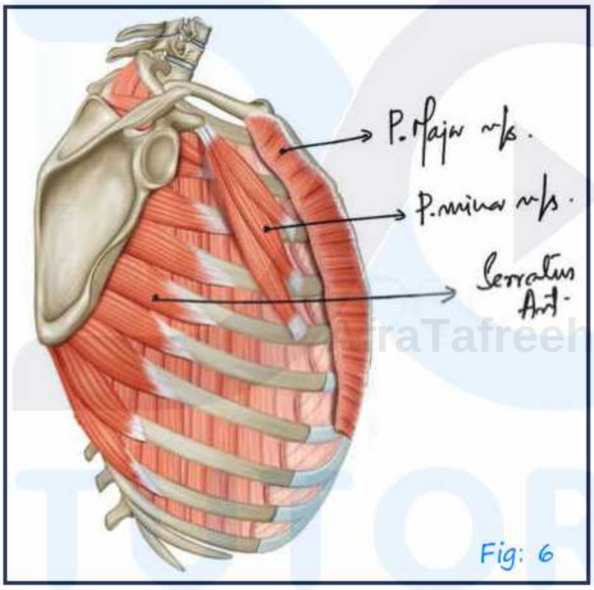

P. Major m/s.
P. minor m/s.
Serratus Ant.

Fig: 6

DOC TUTORIALS
LOGIN FOR SUCCESS
AtraTafreeh.com

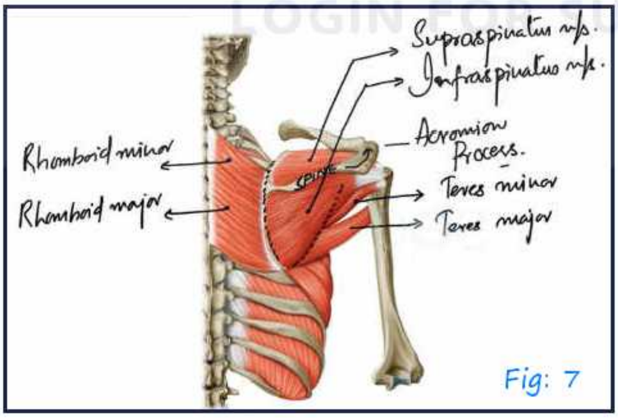

Supraspinatus m/s.
Infraspinatus m/s.
Acromion Process.
Rhomboid minor
SPINE
Rhomboid major
Teres minor
Teres major

Fig: 7

- Spine of the scapula
  - Supraspinatus (above the spine)
  - Infraspinatus (below the spine)

- Teres minor
- Teres major
  - Lateral border of scapula
- Rhomboid minor
- Rhomboid major
  - Medial border of scapula
- Levator scapular muscle

Nerve supply

00:14:17

Major

- Muscles in arm, forearm and hand
  - Musculocutaneous N
  - Median N
  - Axillary N
  - Radial N
  - Ulnar N

Minor

- Muscles surrounding the shoulder region

Minor nerve	Muscles supplied by it
Lateral pectoral N	Pectoralis major (composite muscle)
Medial pectoral N – Pectoralis minor	
Upper subscapular N	Subscapularis (composite / hybrid muscle)
Lower subscapular N – Teres major	
Suprascapular N	Supraspinatus Infraspinatus
Dorsal scapular nerve	Rhomboid major Rhomboid minor Levator scapulae

PECTORAL REGION - II

Axilla 00:00:52

Boundaries of Axilla

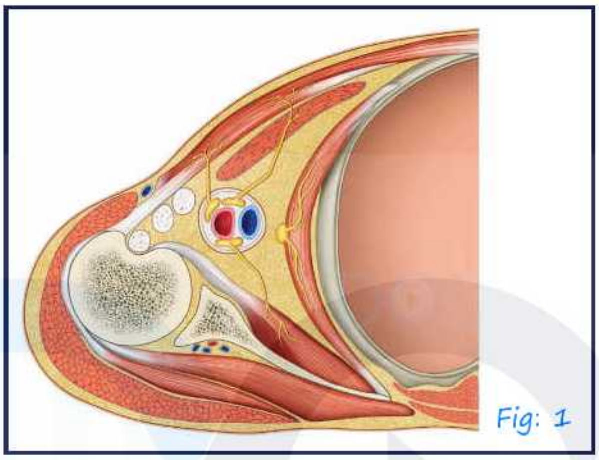


Fig: 1

- Anterior wall or anterior boundary –
  - Pectoralis major
  - Pectoralis minor
- Posterior wall – Subscapularis muscle
- Lateral boundary – Humerus bone
- Medial boundary –
  - Thoracic wall
  - Serratus anterior muscle

Contents

- There is an axillary sheath which encloses the axillary artery and axially vein (Axillary vein is always medial to the axillary artery).
- There are three cords- lateral, posterior and medial cords of the brachial plexus w.r.t axillary artery.

- Posterior cord is behind the artery
  - Medial cord – Medial side
  - Lateral cord – Lateral side

Named with respect to the axillary artery

Contents of Axilla

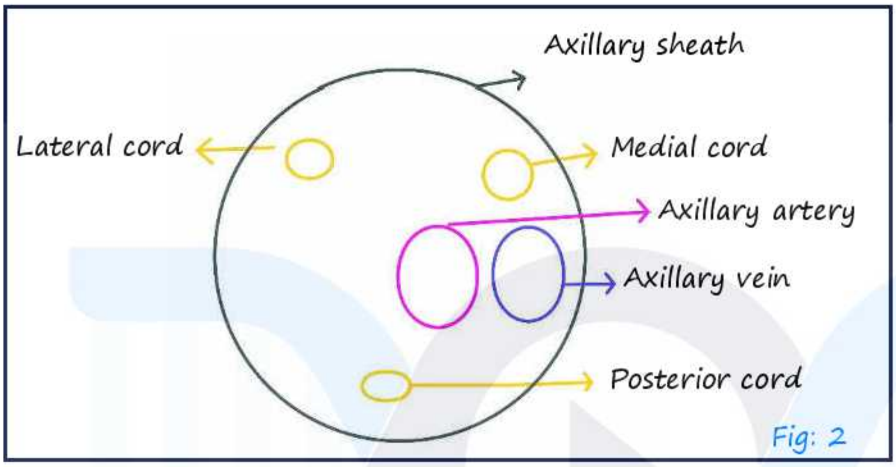

Axillary sheath
Lateral cord
Medial cord
Axillary artery
Axillary vein
Posterior cord

Fig: 2

- **Axillary sheath:** It is the extension of **Prevertebral fascia.**

Sagittal section 00:10:38

- The **clavipectoral fascia** encloses the subclavius muscle, it further splits to enclose the pectoralis minor muscle and it continues down into the axilla as **suspensory ligament of the axilla.**

DOC TUTORIALS LOGIN FOR SUCCESS

Clavipectoral fascia 00:12:20

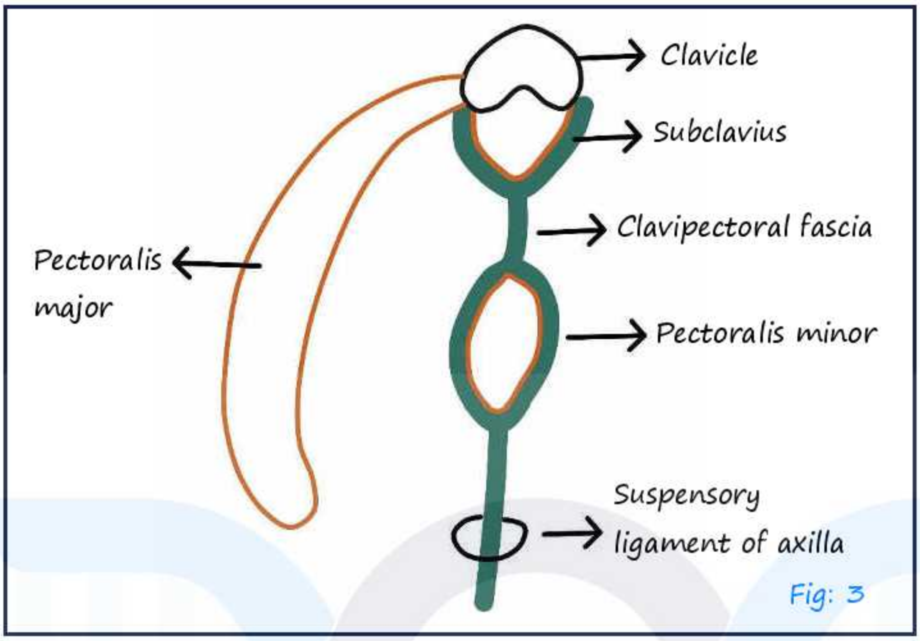

Clavicle
Subclavius
Clavipectoral fascia
Pectoralis major
Pectoralis minor
Suspensory ligament of axilla

Fig: 3

Structure piercing the clavipectoral fascia

1. Cephalic vein
2. Thoraco-acromial artery/ trunk
3. Lateral pectoral nerve

DOC TUTORIALS
LOGIN FOR SUCCESS

Nerve related to humerus 00:15:18

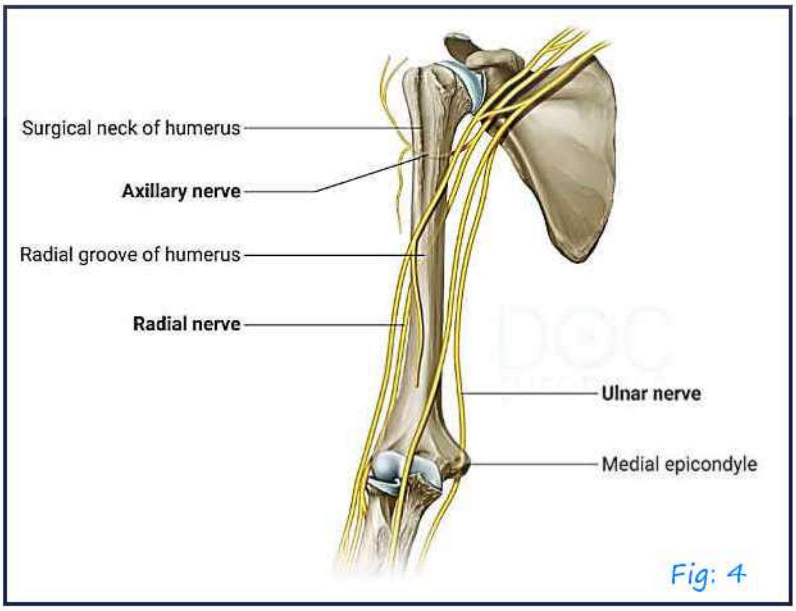

Surgical neck of humerus
Axillary nerve
Radial groove of humerus
Radial nerve
Ulnar nerve
Medial epicondyle

Fig: 4

1. Axillary nerve → passes behind the surgical neck of humerus
2. Radial nerve → passes behind the shaft of humerus through the spiral or radial groove
3. Ulnar nerve

   ↓

   Passes behind the medial epicondyle

Greater tubercle – Lateral side

Lesser tubercle – Anteriorly (in front)

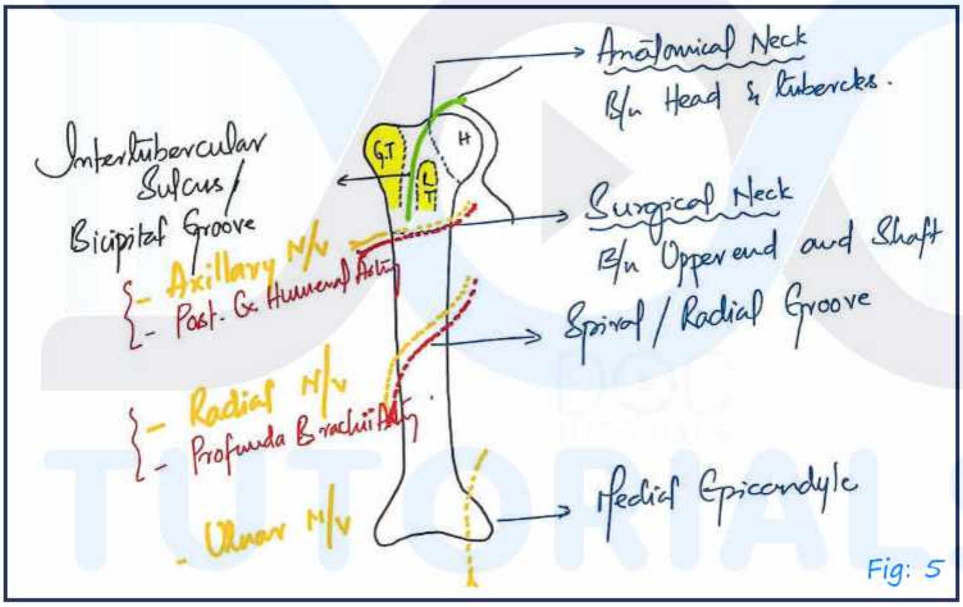

Anatomical Neck
B/n Head & tubercles.
Intertubercular Sulcus / Bicipital Groove
G.T
L.T
H
Surgical Neck
B/n Upper end and Shaft
- Axillary N/v
- Post. Cx Humeral Artery
Spiral / Radial Groove
- Radial N/v
- Profunda Brachii Artery
Medial Epicondyle
- Ulnar N/v

Fig: 5

- Supraglenoid tubercle – Long head of Biceps originates
- Infraglenoid tubercle – Long head of Triceps originates
- Axillary nerve passes behind the surgical neck of humerus
- Radial nerve passes through the spinal nerve, behind the shaft of humerus.

- Ulnar nerve passes behind the medial epicondyle.
- Posterior circumflex humeral artery goes along with the axillary nerve.
- Profunda brachii artery goes along with the radial nerve.

Pectoral region muscles at the back 00:24:44

- The lateral border of the scapula has teres minor muscle and below it, there is teres major muscle and the long head of triceps along with the humerus bone

Intermuscular spaces

1. Quadrangular space
2. Lower triangular space
3. Upper triangular space

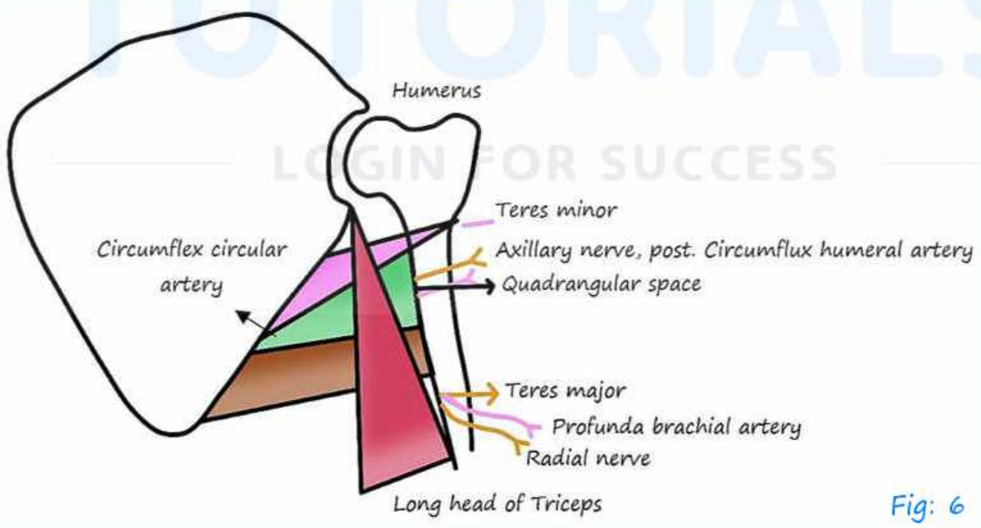

Humerus
Teres minor
Circumflex circular artery
Axillary nerve, post. Circumflux humeral artery
Quadrangular space
Teres major
Profunda brachial artery
Radial nerve
Long head of Triceps

Fig: 6

1. Quadrangular space

- Contents: -
  - Axillary nerve

- Posterior circumflex humeral artery

2.Lower triangular space

- Contents: -
  - Radial nerve
  - Profunda brachii artery

3.Upper triangular space

- Contents: - Circumflex scapular artery

Deltoid muscle 00:32:30

- Muscles are studied under 4 headings; -
  1. Origin
  2. Insertion
  3. Nerve supply
  4. Action
- Deltoid muscle is multipennate muscle – has 3 fibres (Anterior, posterior and lateral fibres of deltoid)
- On the posterior surface of scapula, the spine continues into the acromion process on the lateral side
- The acromion process forms a joint with the clavicle

TUTORIALS LOGIN FOR SUCCESS

Acromio-clavicular joint

Spine of scapula posteriorly	Acromian process laterally	Clavicle anteriorly
↕	↕	↕
Posterior fibres of deltoid	Lateral fibres of deltoid (Acromial fibres)	Anterior fibres of deltoid

The three fibres get inserted into the

Deltoid tuberosity of the humerus

- Nerve supply: - Axillary nerve
- Action:

1. Anterior fibres
   a. Flexion of arm
   b. Medial rotation of arm
2. Posterior fibres
   a. Extension of arm
   b. Lateral rotation of arm
3. Lateral or acromial fibres – Abduction of arm from (15°-90° only)

Abduction of arm 00:40:20

- 0°-15° → supraspinatus
- 15°-90° → Deltoid muscle – lateral fibres

- Above 90° trapezius and serratus anterior (over-head abduction)
- Shape of trapezius muscle → triangular

Rotator cuff/ Musculotendinous 00:43:40

ss- (44:52)

- 4 muscles → SITS
  - Supraspinatus
  - Infraspinatus Insertion

  Greater tubercle on the lateral side
  - Teres minor
  - Subscapularis – gets inserted to the lesser tubercle in front
- All the 4 muscles along with their tendons (musculotendinous) form a cuff where the humerus can be rotated hence the name.

  SIT-S → Subscapularis – lesser tubercle of humerus

  S- Supraspinatus
  I – Infraspinatus
  T – Teres minor

  Greater tubercle of humerus
- Forgotten muscle/ forgotten tendon is the subscapularis of the rotator cuff.

AXILLARY ARTERY

Blood Supply of Upper Limb 00:00:12

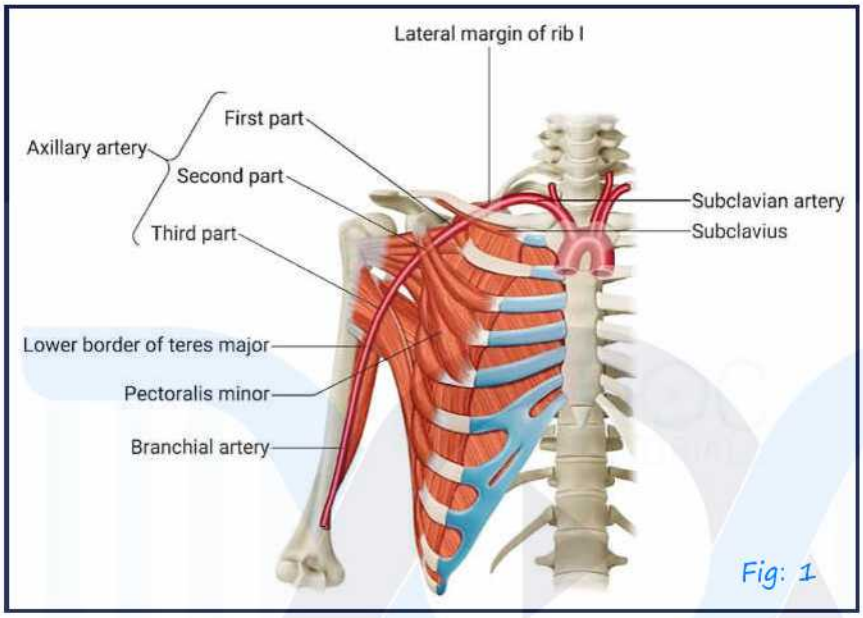

Lateral margin of rib I
Axillary artery
First part
Second part
Third part
Subclavian artery
Subclavius
Lower border of teres major
Pectoralis minor
Branchial artery

Fig: 1

DX TUTORIALS LOGIC FOR SUCCESS

- The Subclavian artery continues as the axillary artery
- Subclavian artery → Axillary artery → Brachial artery (below clavicle)

Brachial artery — in the cubital fossa → Radial artery, Ulnar artery

Radial artery ↓ Deep palmar arch

Ulnar artery ↓ Superficial palmar arch

- Axillary artery begins from the outer border of the first rib and extends up to the lower border of teres major muscle.

$$\text{OUTER BORDER OF FIRST RIB} \xrightarrow{\text{Axillary artery}} \text{LOWER BORDER OF TERES MAJOR}$$

- Axillary artery is divided into 3 parts: by the pectoralis minor muscle (originating from 3rd, 4th and 5th ribs and inserting into the coracoid process of the scapula)
  - FIRST PART → proximal/before pectoralis minor.
  - SECOND PART → Behind pectoralis minor muscle
  - THIRD PART → distal/after the muscle (pectoralis muscle)

Axillary artery 00:04:42

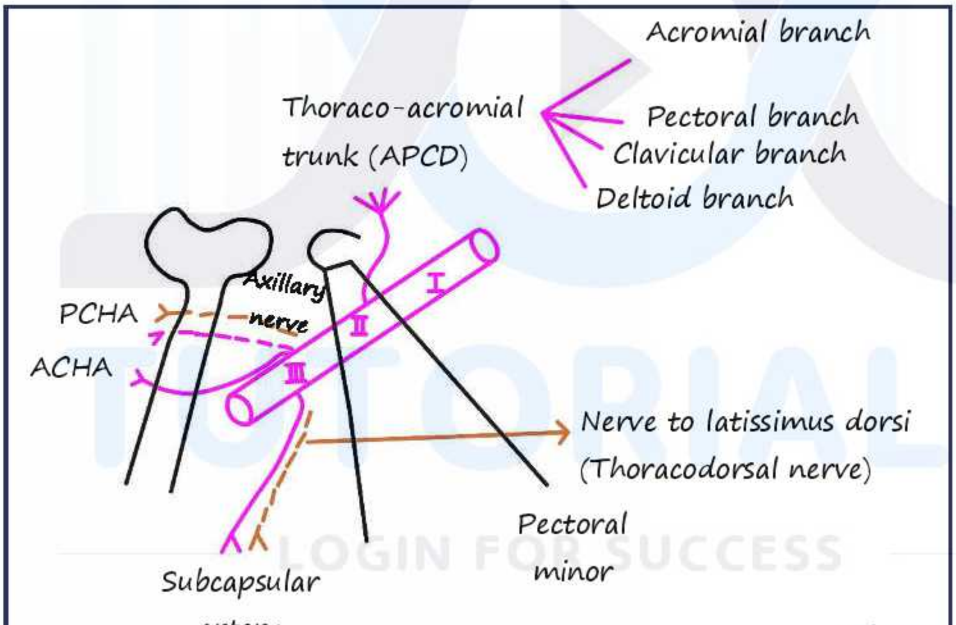

Acromial branch
Thoraco-acromial trunk (APCD)
Pectoral branch
Clavicular branch
Deltoid branch
Axillary nerve
PCHA
ACHA
I
II
III
Nerve to latissimus dorsi (Thoracodorsal nerve)
Pectoral minor
Subcapsular artery

Fig: 2

- 1st part → 1 branch – Superior thoracic artery (above thorax)
- 2nd part → 2 branches:
  - Lateral thoracic artery (lateral to thorax)

- Thoraco-acromial trunk (going towards acromion process)

(4 branches → APCD)

Acromial branch

Pectoral branch

Clavicular branch

Deltoid branch

- 3^{rd} part → 3 branches:
  - Anterior circumflex humeral artery
  - Posterior circumflex humeral artery

  } around the neck of humerus
  - Subscapular artery (below the scapula)
- Axillary nerve accompanies the posterior circumflex humeral artery (goes behind the surgical neck of humerus)
- Nerve to latissimus dorsi goes along with subscapular artery

  ↓

  also called Thoraco-dorsal nerve.
- Subscapular artery – Largest branch of Axillary artery.

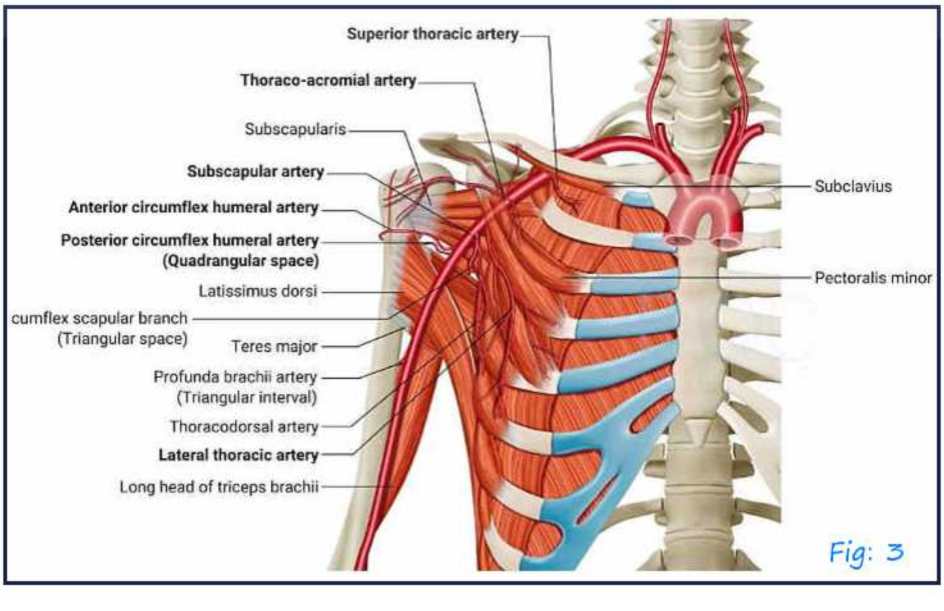

Superior thoracic artery
Thoraco-acromial artery
Subscapularis
Subscapular artery
Anterior circumflex humeral artery
Posterior circumflex humeral artery
(Quadrangular space)
Latissimus dorsi
cumflex scapular branch
(Triangular space)
Teres major
Profunda brachii artery
(Triangular interval)
Thoracodorsal artery
Lateral thoracic artery
Long head of triceps brachii
Subclavius
Pectoralis minor

Fig: 3

SCAPULAR ANASTOMOSIS

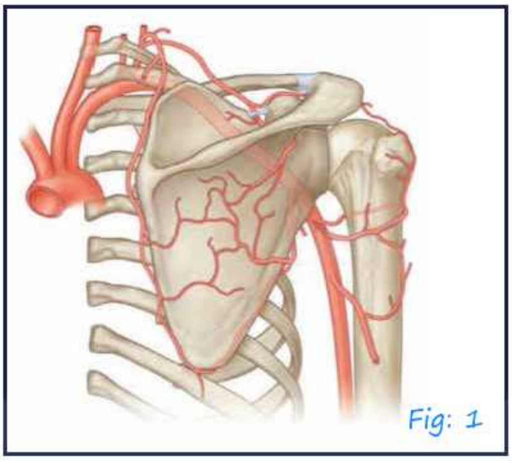


Fig: 1

- The subclavian artery continues as the axillary artery which is divided into 3 parts (first, second and third).
- The third part of the axillary artery gives 3 branches
  1. Anterior circumflex humeral artery
  2. Posterior circumflex humeral artery
  3. The largest branch → Subscapular artery
- The subscapular artery while moving down, it gives a branch which takes a turn → called the circumflex scapular artery. This passes through the upper triangular space.
- Scalenus anterior muscle divides the subclavian artery into 3 parts: First, second and third part
- The 1st part of the subclavian artery in turn gives 3 branches (VIT)
  - V – Vertebral artery (goes upwards)
  - I – Internal thoracic artery (goes down giving anterior intercostal arteries etc.)
  - T – Thyrocervical trunk

TUTORIALS LOGIN FOR SUCCESS

Thyrocervical trunk 00:04:42

- The thyrocervical trunk further divides into 3 branches (SIT)
  1. Suprascapular artery
  2. Inferior thyroid artery
  3. Transverse cervical artery
- The suprascapular artery takes a turn at root of the spine of the scapula and forms the anastomosis.
- The scapular anastomosis will be between the first part of the subclavian artery with the third part of the axillary part (1st part of SCA + 3rd part of AA).
- At the inferior angle of the scapula, there is another anastomosis.
- The transverse cervical artery divides into 2 branches:
  - Superficial branch
  - Deep branch → runs along the medial border and forms anastomosis at the inferior angle of scapula with the subscapular artery
  - The deep branch while moving down along the medial border, it gives certain branches that form anastomosis the body of the scapula.
- Another anastomosis is formed at the acromian process.
  - The acromial branch of posterior circumflex humeral artery → Acromial anastomosis

DOT TUTORIALS
LOGIN FOR SUCCESS

Scapular Anastomosis

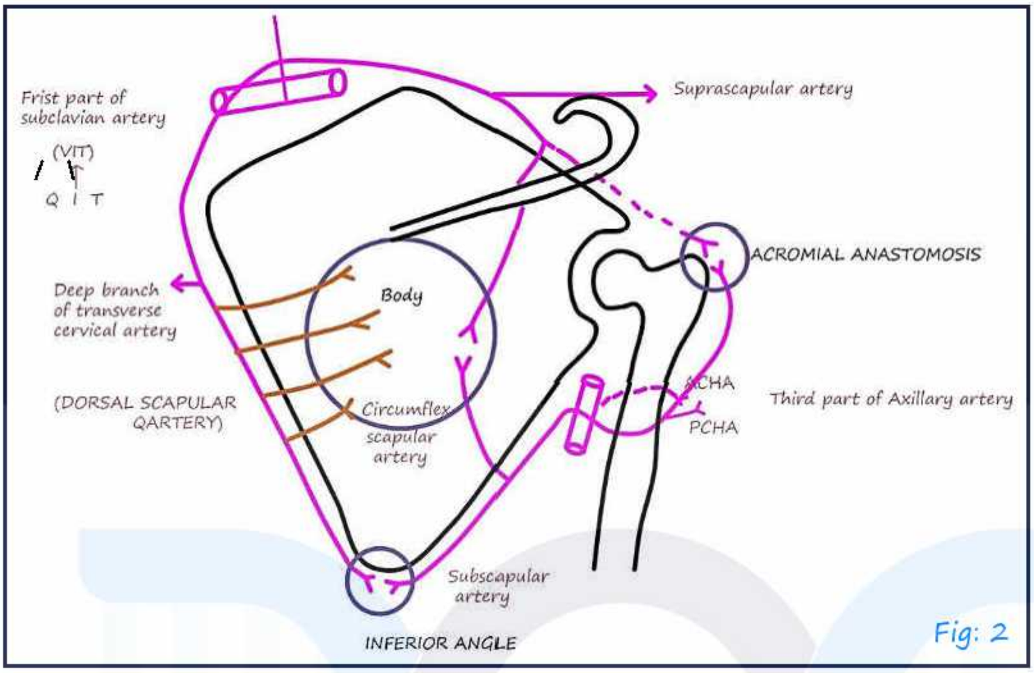

Frist part of subclavian artery
(VIT)
Q I T
Suprascapular artery
ACROMIAL ANASTOMOSIS
Deep branch of transverse cervical artery
Body
(DORSAL SCAPULAR QARTERY)
Circumflex scapular artery
ACHA
PCHA
Third part of Axillary artery
Subscapular artery
INFERIOR ANGLE

Fig: 2

- On the body of the scapula, arteries contributing to the formation of anastomosis are:
  - Suprascapular artery from above
  - Circumflex scapular artery
  - Dorsal scapular artery

Thyrocervical trunk: -

- At the inferior angle, anastomosis is formed by
  - Dorsal scapular artery
  - Subscapular artery
- Acromial anastomosis is formed by the acromial branches of:
  - Suprascapular artery
  - Posterior circumflex humeral artery

BRACHIAL ARTERY

Brachial Artery 00:00:16

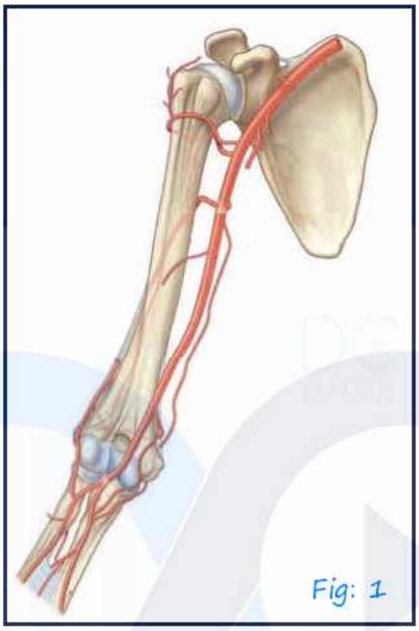


Fig: 1

- Brachial artery is in the arm (Brachium) – anterior compartment
- Brachial artery goes into the cubital fossa and in the cubital fossa it divides into: (2 branches)
  - Radial artery on the lateral side
  - Ulnar artery on the medial side
- Brachial artery gives a branch, that goes in the spiral groove – profunda brachii artery along with radial nerve
- This profunda brachii artery is the deep branch of brachial artery that supplies the posterior compartment of the arm

- Arm has two compartments
  - Anterior compartment → supplied by brachial artery
  - Posterior compartment → supplied by profunda brachii artery, a deep branch of brachial artery
- Profunda brachii artery divides into 2 branches:
  - One in front of the lateral epicondyle – anterior descending branch
  - One behind the lateral epicondyle → posterior descending branch
- The anterior descending branch of the profunda brachii artery is along the radial nerve, hence called as radial collateral artery.
- The posterior descending branch is also known as the middle collateral artery.
- On the medial side, the branchial artery gives two branches:
  - Superior ulnar collateral artery → goes behind the medial epicondyle
  - Inferior ulnar collateral artery.

Summary

- Brachial artery gives rise to:

  i. Profunda brachii artery

  ii. Superior ulnar collateral artery

  iii. Inferior ulnar collateral artery
- Brachial artery divides into:

- Radial artery
- Ulnar artery

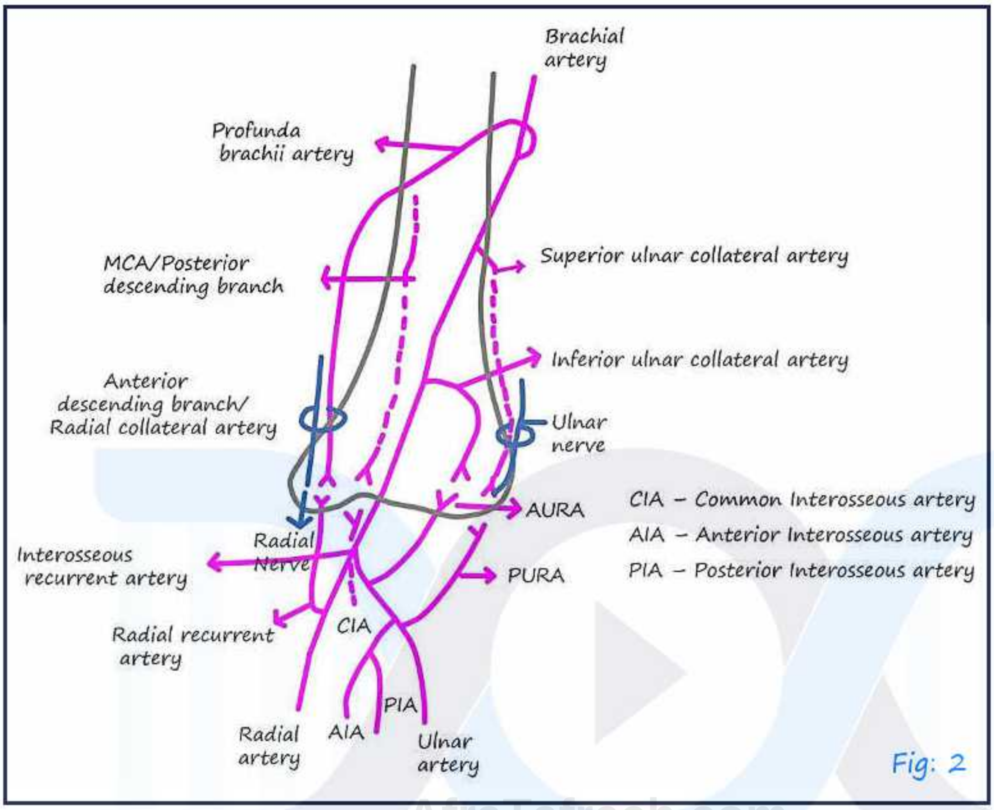

Brachial artery
Profunda brachii artery
MCA/Posterior descending branch
Superior ulnar collateral artery
Inferior ulnar collateral artery
Anterior descending branch/ Radial collateral artery
Ulnar nerve
AURA
CIA – Common Interosseous artery
AIA – Anterior Interosseous artery
PIA – Posterior Interosseous artery
Radial Nerve
Interosseous recurrent artery
PURA
CIA
Radial recurrent artery
PIA
Radial artery
AIA
Ulnar artery

Fig: 2

Anastamosis at the Elbow Joint: 00:10:38

- Ulnar artery gives rise to common interosseous artery, which further divides into anterior interosseous and posterior interosseous.
- Then ulnar artery gives two branches which go backward to form the anastomosis, they are:
  1. Posterior ulnar recurrent artery which forms the anastomosis with superior ulnar collateral artery behind.
  2. Anterior ulnar recurrent artery which forms anastomosis with inferior ulnar collateral artery in the front.

- The radial artery gives a branch → Radial recurrent artery which forms anastomosis with the radial collateral artery.
- The posterior interosseous artery gives a branch which goes behind and form anastomosis with posterior descending branch called the interosseous recurrent artery.
- Mnemonic → R M I S
  R I A P ← (PAIR)

PALMAR ARCHES

Palmar Arches 00:00:28

INTEROSSEOUS ARTERY

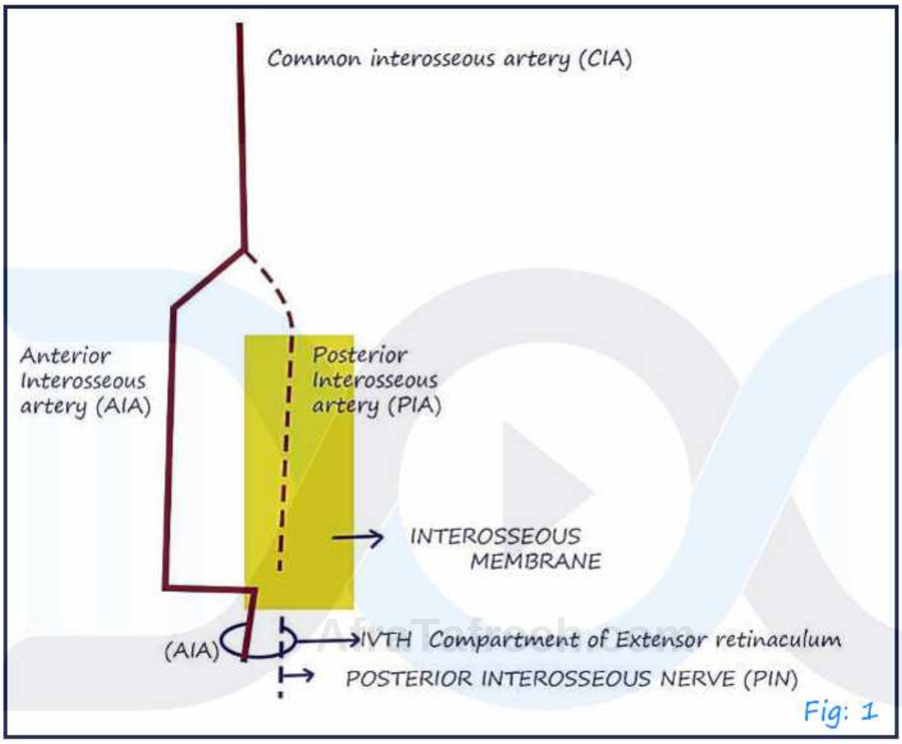

Common interosseous artery (CIA)
Anterior Interosseous artery (AIA)
Posterior Interosseous artery (PIA)
INTEROSSEOUS MEMBRANE
(AIA)
IVTH Compartment of Extensor retinaculum
POSTERIOR INTEROSSEOUS NERVE (PIN)

Fig: 1

- In the lower end, the anterior interosseous artery (AIA) is piercing the interosseous membrane and goes behind the interosseous membrane.
- In the lower part, the anterior interosseous artery travels along with the posterior interosseous nerve, which is a branch of radial nerve. These two pass through the extensor retinaculum.
- Extensor retinaculum has 6 compartments, compartments & has anterior interosseus artery and posterior interosseous nerve mentioned above.

PALMAR ARCHES

Palmar arches

Superficial palmar arch
(formed by the ulnar artery)

Deep palmar arch
(formed by the radial artery)

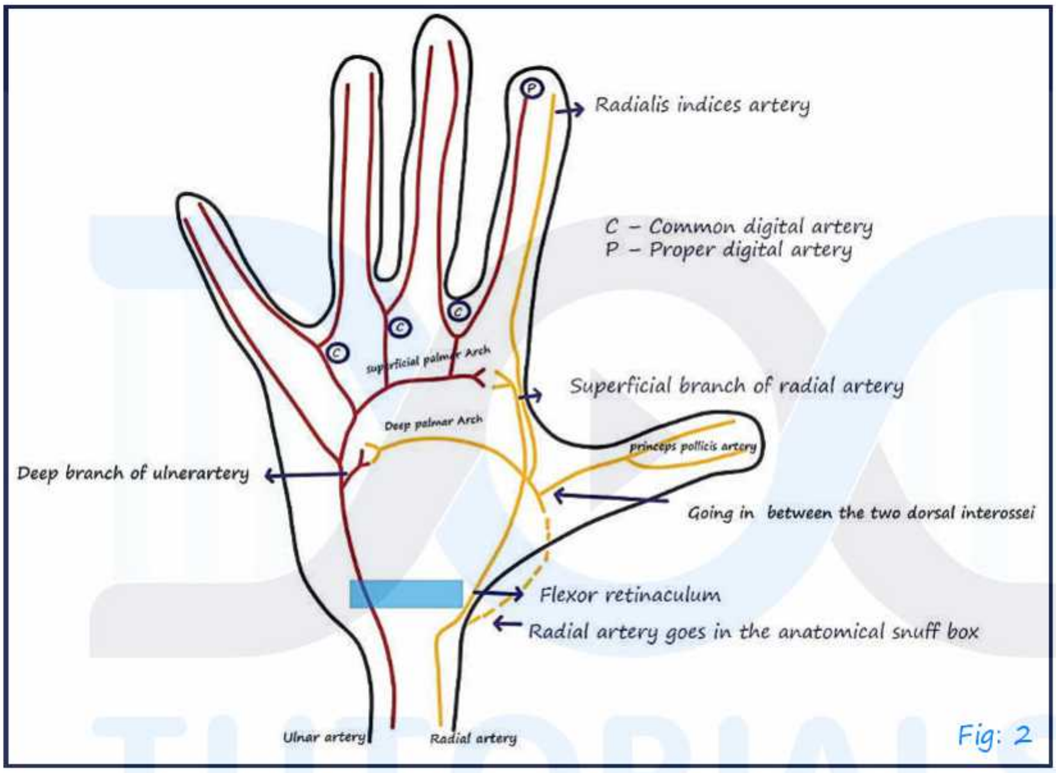

Radialis indices artery
C – Common digital artery
P – Proper digital artery
C
C
C
P
superficial palmar Arch
Superficial branch of radial artery
Deep palmar Arch
princeps pollicis artery
Deep branch of ulnerartery
Going in between the two dorsal interossei
Flexor retinaculum
Radial artery goes in the anatomical snuff box
Ulnar artery
Radial artery

Fig: 2

DOC TUTORIALS
LOGIN FOR SUCCESS

- On the medial side, the ulnar artery passes superficial to the flexor retinaculum and continues to form the superficial palmar arch.
- On the lateral side, the radial artery goes behind into the anatomical snuff box, pierces the dorsal interossei and forms the deep palmar arch.
- Radial artery
  - Is going in the anatomical snuff box
  - Is going via or through the dorsal interossei

- The superficial arch is completed by a branch of the radial artery (superficial branch)
- The deep palmar arch is completed by a branch from the ulnar artery (deep branch)
- Radial artery gives a branch to the thumb called princeps pollicis artery and radialis indices artery → 2 branches of radial artery
- Ulnar artery gives rise to the common digital arteries which divide further into proper digital arteries. It also gives a branch to the little finger

CARPAL TUNNEL

Carpal Bones 00:00:15

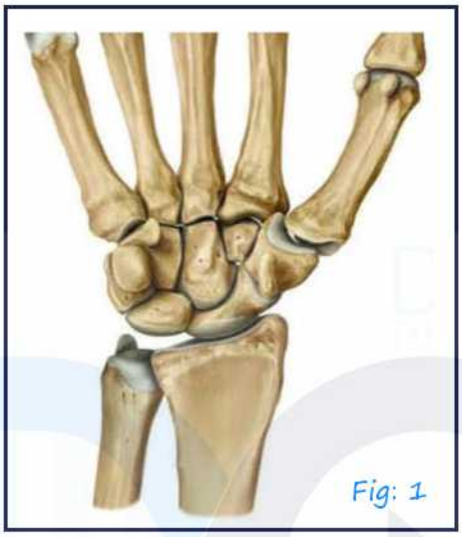


Fig: 1

- 8 Carpal bones are arranged in 2 rows – 4 carpal bones arranged in the proximal row and 4 carpal bones arranged in the distal row.
- Proximal row → scaphoid, lunate, triquetrum and pisiform.
  - pisiform is a **sesamoid bone**. sesamoid bone ossifies in the tendon – Flexor carpi ulnaris tendon
- Distal row → Trapezium, Trapezoid, Capitate (largest) and Hamate.
- Mnemonic of carpal bones – she looks too pretty try to catch her [Scaphoid, Lunate, Triquetrum, Pisiform, Trapezium, Trapezoid, Capitate, Hamate]

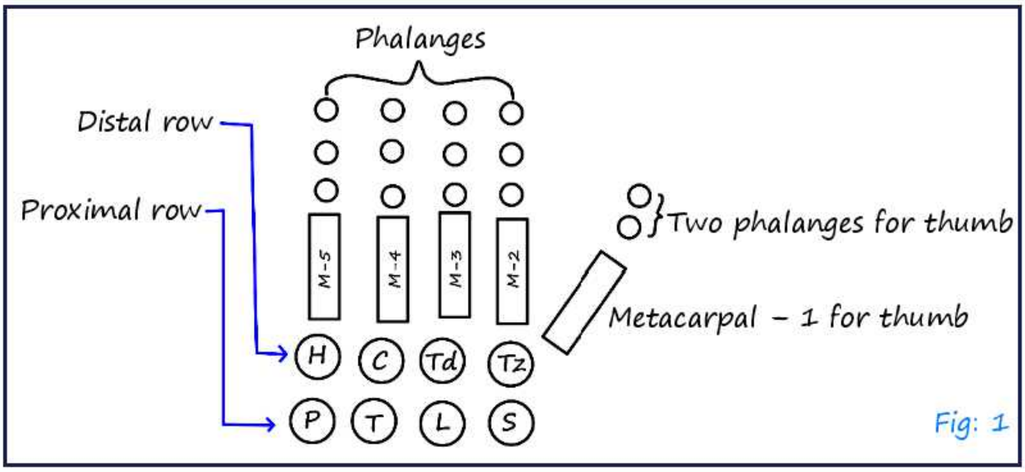

Phalanges
Distal row
Proximal row
M-5
M-4
M-3
M-2
Two phalanges for thumb
Metacarpal – 1 for thumb
H
C
Td
Tz
P
T
L
S

Fig: 1

- Thumb is towards the lateral side.
  - Largest carpal bone → capitate
  - Smallest → pisiform
  - Most commonly dislocated → lunate
  - Most commonly fractured → Scaphoid
  - Scaphoid undergoes avascular necrosis → proximal part of scaphoid
  - Sesamoid bone → pisiform.

Carpal Tunnel 00:06:58

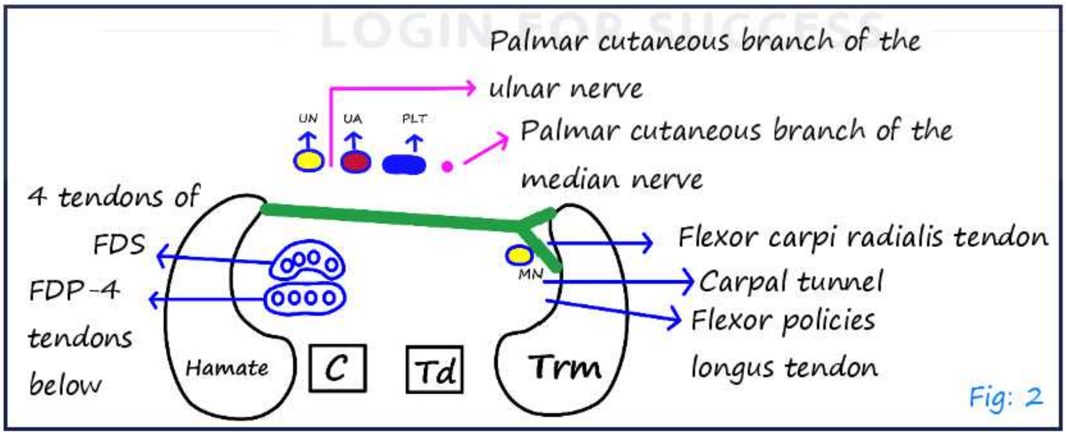

Palmar cutaneous branch of the ulnar nerve
UN
UA
PLT
Palmar cutaneous branch of the median nerve
4 tendons of FDS
FDP-4 tendons below
Hamate
C
Td
Trm
MN
Flexor carpi radialis tendon
Carpal tunnel
Flexor policies longus tendon

Fig: 2

- Ulnar nerve, ulnar artery, palmaris longus tendon → structures passing superficial to the flexor retinaculum along with the palmar cutaneous branch of the ulnar nerve and palmar cutaneous branch of the median nerve.

- Flexor carpi radialis tendon is passing through the flexor retinaculum (neither superficial nor deep to the FR)

Structures passing deep to flexor retinaculum: (passing through carpal tunnel)

- Flexor digitorum superficialis – four tendons – above
- Flexor digitorum profundus – four tendons – below.
- Median nerve
- Flexor policis longus.

CUBITAL FOSSA

- Cubital fossa is a triangular depression in front of the elbow joint.

Fig: 1

Boundaries: [Base, Two sides] 00:00:39

- Base – An imaginary line joining the lateral epicondyle and the medial epicondyle of humerus.
- Lateral side – Brachioradialis muscle
- Medial side – Pronator teres muscle.

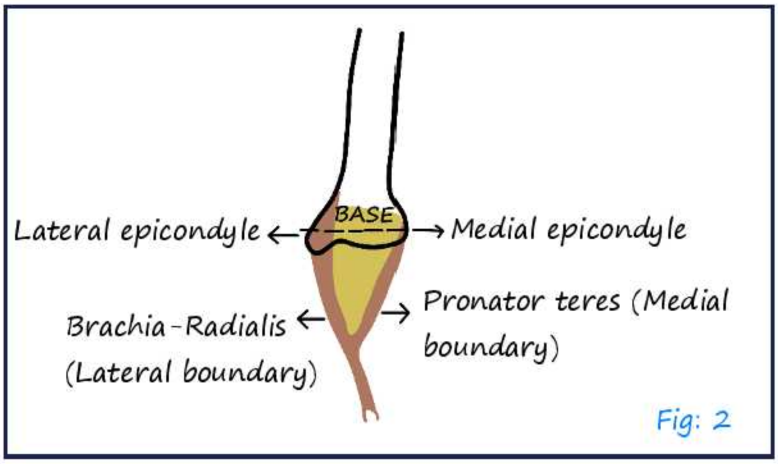

BASE
Lateral epicondyle
Medial epicondyle
Brachia-Radialis (Lateral boundary)
Pronator teres (Medial boundary)

Fig: 2

Floor

i. Brachialis vein (medial side)
ii. Supinator muscle (lateral side)

Roof

i. Cephalic vein
ii. Basilic vein
} connected together as median cubital vein
iii. Medial cutaneous nerve of the forearm → direct branch of medial cord of B.P
iv. Lateral cutaneous nerve of the forearm – continuation of Musculo-cutaneous nerve

Contents

i. Medial nerve
ii. Branchial artery → Radial artery
→ Ulnar artery
iii. Biceps brachii tendon
iv. Radial nerve (superficial branch)
v. Contents of cubital fossa – MBBS (from medial to lateral side)
(Median nerve, Brachial artery, Biceps brachii tendon and Superficial branch of radial nerve)

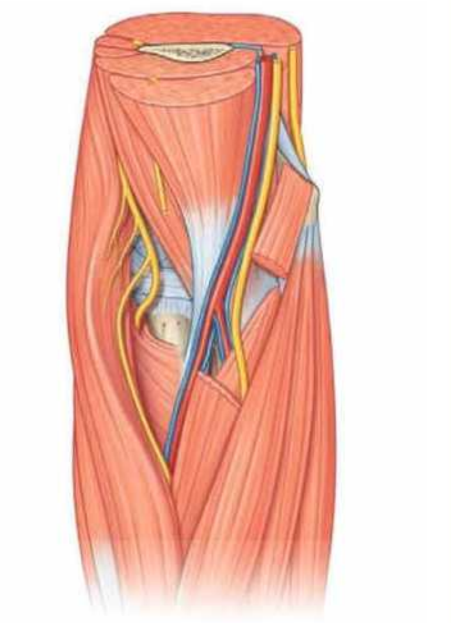


Fig: 3

LUMBOSACRAL PLEXUS AND MAJOR NERVES

Lumbosacral plexus 00:02:16

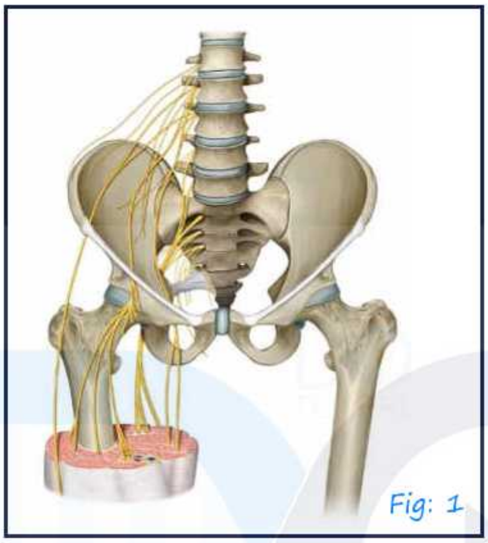
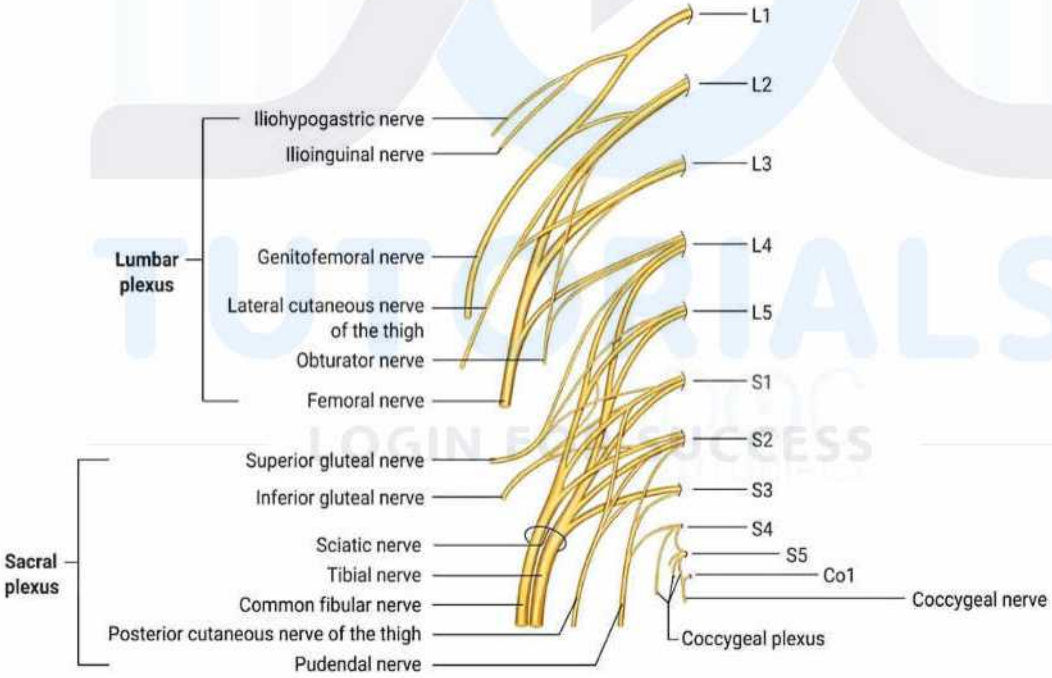


Fig: 1


L1
L2
Iliohypogastric nerve
Ilioinguinal nerve
L3
Lumbar plexus
Genitofemoral nerve
L4
Lateral cutaneous nerve of the thigh
L5
Obturator nerve
S1
Femoral nerve
S2
Superior gluteal nerve
Inferior gluteal nerve
S3
S4
Sacral plexus
Sciatic nerve
S5
Tibial nerve
Co1
Common fibular nerve
Coccygeal nerve
Posterior cutaneous nerve of the thigh
Coccygeal plexus
Pudendal nerve

- Only has divisions
  - Anterior division
  - Posterior division

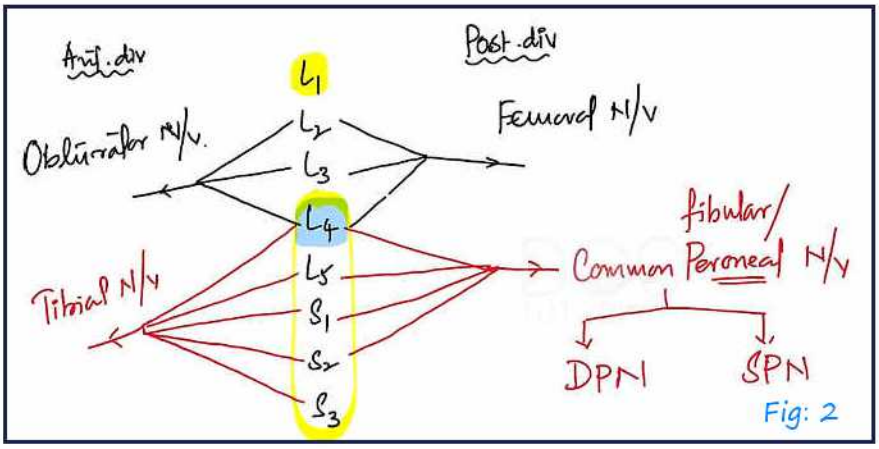
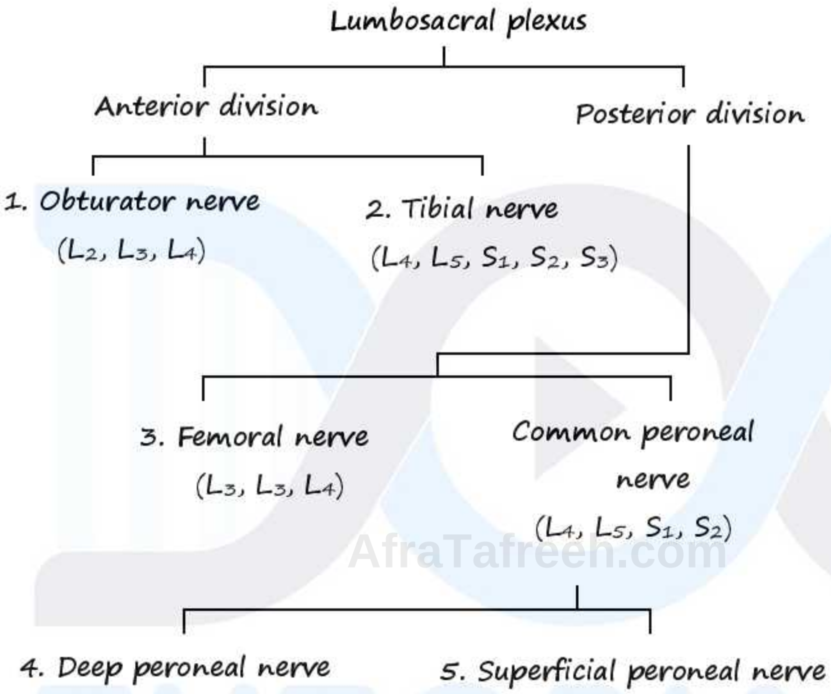

Ant. div
Post. div
L1
L2
L3
L4
L5
S1
S2
S3
Obturator N/v.
Femoral N/v
fibular/
Common Peroneal N/v
Tibial N/v
DPN
SPN

Fig: 2


Lumbosacral plexus
Anterior division
Posterior division
1. Obturator nerve
(L2, L3, L4)
2. Tibial nerve
(L4, L5, S1, S2, S3)
3. Femoral nerve
(L3, L3, L4)
Common peroneal nerve
(L4, L5, S1, S2)
4. Deep peroneal nerve
5. Superficial peroneal nerve

Note

1. **Nervus furcalis:** L_4 is referred to as nervus furcalis because it contributes to all the nerves of lumbosacral plexus
2. **Sciatic nerve:** It is a sheath enclosing the tibial nerve and common peroneal nerve
   - Origin: $L_4 - S_3$

Sciatic nerve 00:12:18

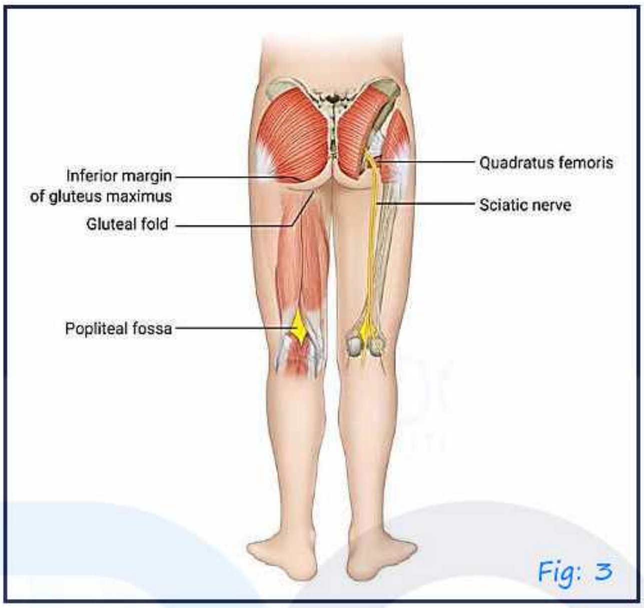

Inferior margin of gluteus maximus
Gluteal fold
Popliteal fossa
Quadratus femoris
Sciatic nerve

Fig: 3

- It comes into gluteal region through the greater sciatic foramen
- Sciatic nerve →

Exists out into the gluteal region through the greater sciatic foramen

↓ Descends down into the posterior compartment of thigh

Enter into the popliteal fossa

Upper part of popliteal fossa, it divides into

Tibial nerve (Medial side)

Common peroneal nerve (lateral side)

3.Accessory obturator nerve: (not always present)

- It present, if originates from L_3 and L_4

TUTORIALS LOGIN FOR SUCCESS

Thigh has 3 compartments: -

3 compartments

- **Anterior**
- **Posterior**
- **Medial**
  - Adductors

- Leg – 3 compartments
  1. Anterior compartment
  2. Posterior compartment
  3. Lateral compartment
- Foot
  - No compartments
  - Arranged in 4 layers

Major nerve 00:17:34

Thigh

- Anterior compartment ← Femoral nerve
- Medial compartment ← Obturator nerve (Adductors)
- Posterior compartment ← Tibial nerve

TUTORIALS LOGIN FOR SUCCESS

Leg

- Anterior compartment ← Deep nerve
- Lateral compartment ← Superficial peroneal nerve
- Posterior compartment ← Tibial nerve

Foot

- 4 layers ← Lateral and medial plantar nerves
- Tibial nerve branches

COMMON PERONEAL (FIBULAR) NERVE

- There are 5 major nerves in the lower limb: -

  1. Tibial nerve ┐ **Sciatic nerve**
  2. Common peroneal nerve ┘
     - Deep peroneal nerve
     - Superficial peroneal nerve
  3. Femoral nerve
  4. Obturator nerve

Common peroneal nerve (Common fibular nerve)

00:00:28

- Origin: -
  - Posterior division of L_4 to S_2
  - It is a part of sciatic nerve (TN + CPN)
- Supplies to

CPN

Deep peroneal nerve

- Anterior compartment of leg
  - Peroneus tertius
  - Tibialis anterior
  - Extensor hallucis longus
  - Extensor digitorum longus

Superficial peroneal nerve

- Lateral compartment of leg
  - Peroneus longus
  - Peroneus brevis

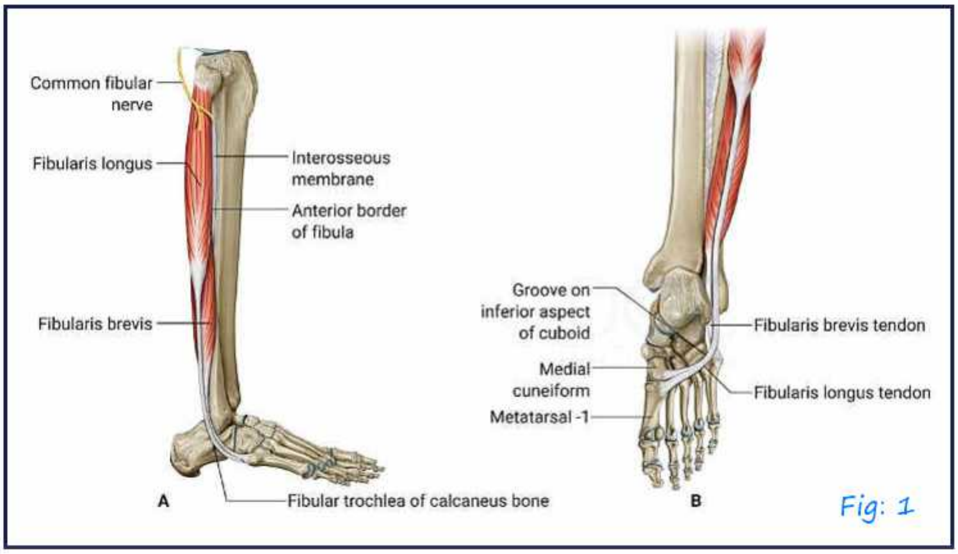

Common fibular nerve
Fibularis longus
Interosseous membrane
Anterior border of fibula
Fibularis brevis
A
Fibular trochlea of calcaneus bone
Groove on inferior aspect of cuboid
Medial cuneiform
Metatarsal -1
Fibularis brevis tendon
Fibularis longus tendon
B

Fig: 1

Sensory supply

- Deep peroneal nerve
  - Skin in the cleft of first and second toe. i.e., the First web space
- Superficial personal nerve: - Skin on the dorsum of the foot

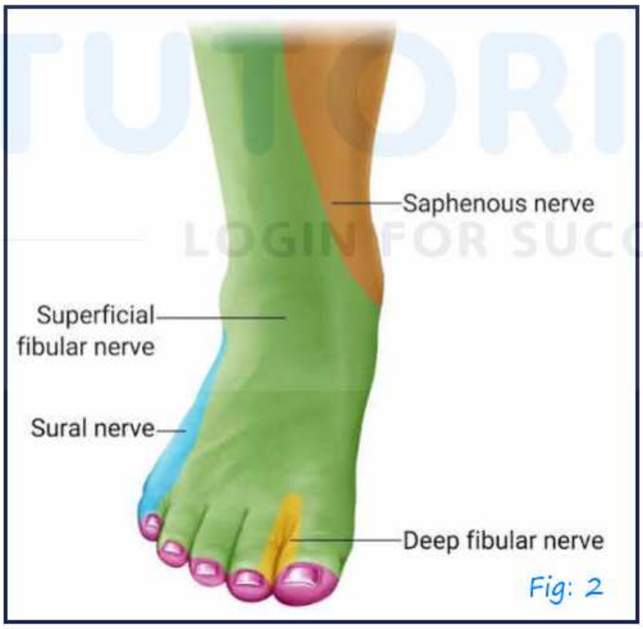

Saphenous nerve
Superficial fibular nerve
Sural nerve
Deep fibular nerve

Fig: 2

Applied aspect 00:14:28

- Injury to

CPN
- SPN → loss of eversion
- DPN → foot drop

High stepping gait due to injury to common peroneal nerve

- Contraction of peroneus longus and peroneus brevis leads to the elevation of the foot.
- Injury to superficial peroneal nerve → loss of eversion of the foot due to involvement of PL + PB
- Foot drop → Injury to deep peroneal nerve (anterior compartment muscles)

TIBIAL NERVE AND SOLE OF FOOT

Tibial nerve 00:00:57

- Origin: Anterior division of L4 to S3
- It is a part of sciatic nerve (Tibial nerve + common peroneal nerve)
- Supplies to: Posterior compartment of thigh:
  - Hamstrings:

    Semitendinosus

    Semi membranous

    Biceps femoris < Long head – TN / Short head – CPN } True Hamstrings
  - Adductor magnus – Hamstring part of adductor magnus

DOC TUTORIALS LOOKING FOR SUCCESS

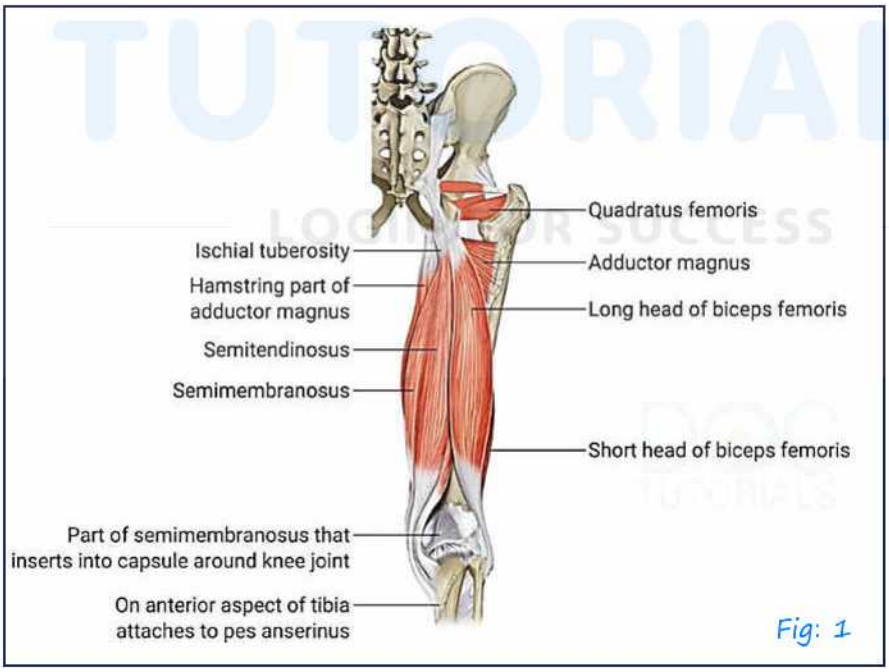

Ischial tuberosity
Hamstring part of adductor magnus
Semitendinosus
Semimembranosus
Part of semimembranosus that inserts into capsule around knee joint
On anterior aspect of tibia attaches to pes anserinus
Quadratus femoris
Adductor magnus
Long head of biceps femoris
Short head of biceps femoris

Fig: 1

Note: Adductor magnus (Composite/Hybrid muscle)

- Adductor part ↑ Obturator nerve
- Hamstring part ↑ Tibial nerve

- Muscle supplied by two nerves is a composite muscle or hybrid muscle
- True hamstrings – Semitendinosus
  Semimembranosus
  Long head of biceps femoris
- Modified or false hamstrings – Short head of biceps femoris
  Hamstring part of adductor magnus

Posterior compartments of leg

- Lateral head and medial head of gastrocnemius muscle
- Soleus muscle (Peripheral heart)
- Plantaris muscle (Has the longest tendon)
- Tibialis posterior
- Flexor hallucis longus
- Flexor digitorum longus

Tibialis posterior, Flexor hallucis longus, Flexor digitorum longus – Deep layer

Posterior compartment of leg

Superficial layer	Deep layer
- Lateral and medial heads of gastrocnemius	- Tibialis posterior
- Soleus	- Flexor hallucis longus
- Plantaris	- Flexor digitorum longus

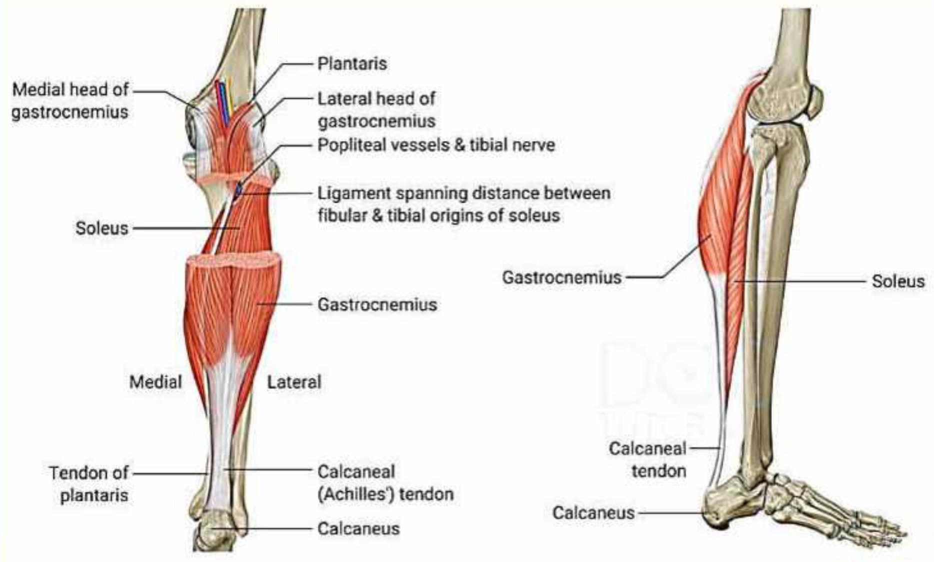

Medial head of gastrocnemius
Plantaris
Lateral head of gastrocnemius
Popliteal vessels & tibial nerve
Ligament spanning distance between fibular & tibial origins of soleus
Soleus
Gastrocnemius
Medial
Lateral
Tendon of plantaris
Calcaneal (Achilles') tendon
Calcaneus
Gastrocnemius
Soleus
Calcaneal tendon
Calcaneus

Fig: 2

DOC TUTORIALS
LOGIN FOR SUCCESS

- Triceps surae
  - Lateral medial heads of gastrocnemius
  - Soleus
- Peripheral heart of the body → Soleus (When a person walks it contracts and relaxes as a result the blood gets pumped back into the circulation)
- Plantaris has the longest tendon in the entire body
- Neurovascular bundle is absent in the superficial layer of the posterior compartment of leg

Muscles of the foot 00:20:02

- Lateral plantar nerve → Dominant nerve in the foot
- Sole of foot (First layer): 3 muscles

  1.Abductor hallucis → Medial plantar nerve

  2.Abductor digiti minimi → Lateral plantar nerve

  3.Flexor digitorum brevis → Medial plantar nerve

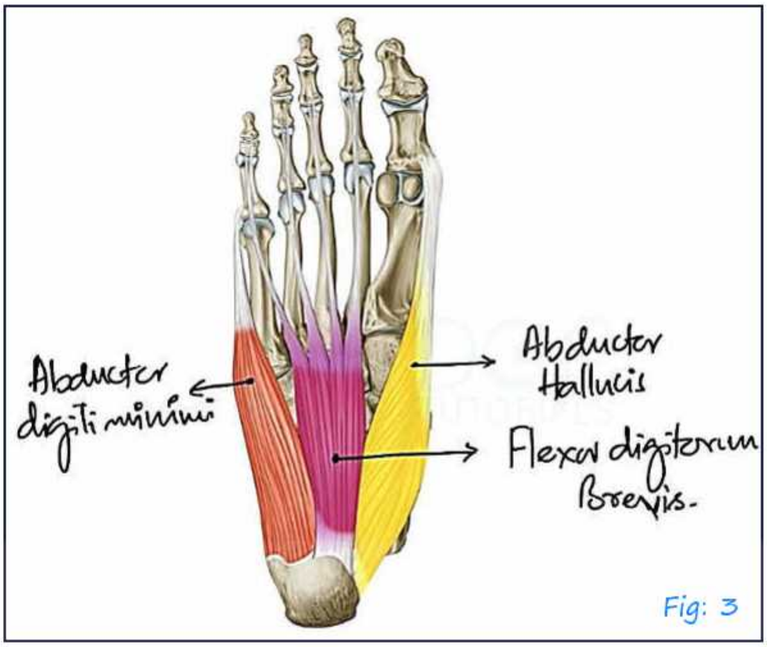

Abducter digiti minimi
Abducter Hallucis
Flexor digitorum Brevis.

Fig: 3

- Sole of foot (Second layer) → 2 tendons (FHL, FDL) or 2 muscles

- 2 Tendons

1.Flexor hallucis longus tendon

2.Flexor digitorum longus tendon

- 2 muscles

1.Quadratus plantae/Flexor digitorum accessories (LPN)

2.Lumbricals (L1, L2, L3 and L4)

- L1 – Unipennate → Medial plantar nerve
- L2
- L3 } Bipennate → Lateral plantar nerve
- L4

TUTORIALS LOGIN FOR SUCCESS

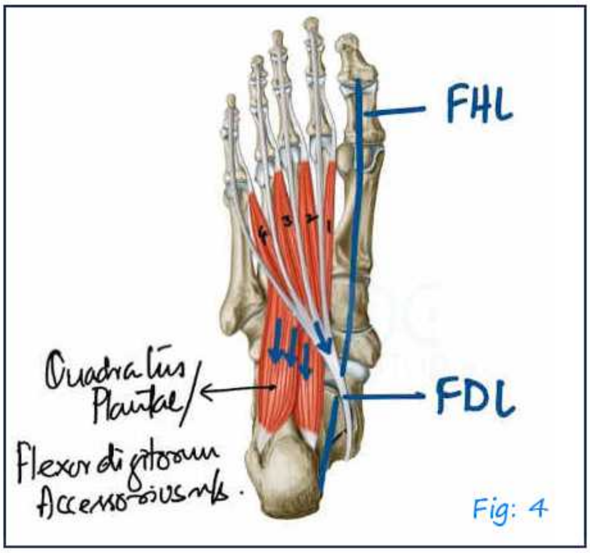

FHL
FDL
4 3 2 1
Quadratus Plantae/ Flexor digitorum Accessorius m/s.

Fig: 4

- Sole of foot (Third layer) – 3 muscles

  1. Flexor hallucis brevis → Medial plantar nerve
  2. Flexor digiti minimi → Lateral plantar nerve
  3. Adductor hallucis → Lateral plantar nerve

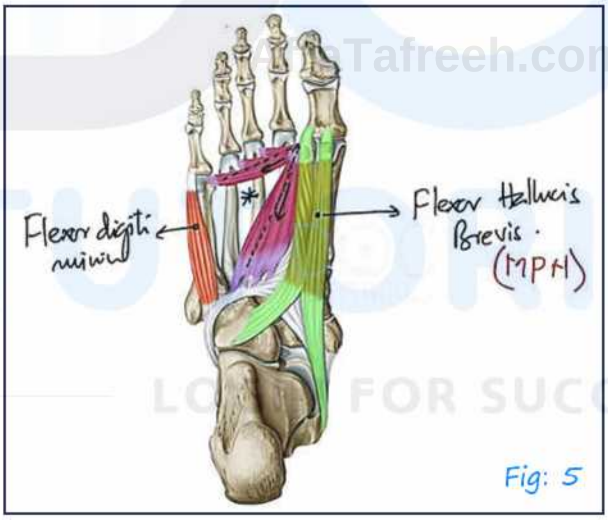

Flexor digiti minimi
*
Flexor Hallucis Brevis.
(MPN)

Fig: 5

AnaTafreeh.com
TUTORIALS
LOGIC FOR SUCCESS

- Sole of foot (Forth layer) – Interossei

  1. Plantar interossei – 3 (Unipennate)
  2. Dorsal interossei – 4 (Bipennate)

  Lateral plantar nerve

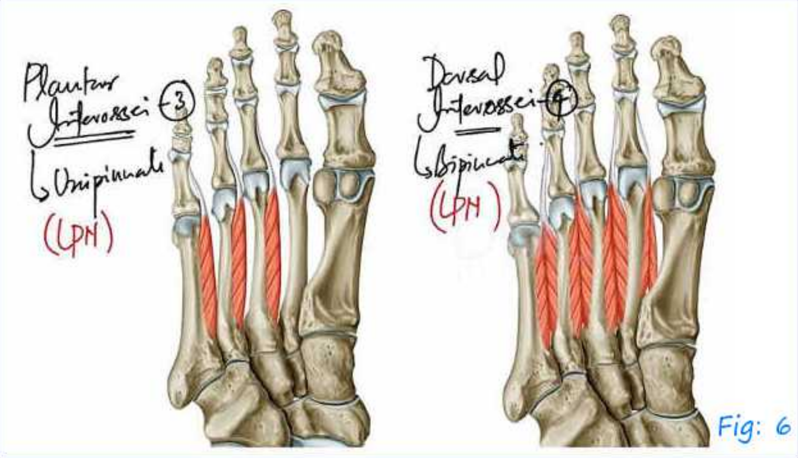

Plantar Interossei ③
↳ Unipinnate
(LPN)
Dorsal Interossei ④
↳ Bipinnate
(LPN)

Fig: 6

- Medial plantar nerve supplies to 4 muscles and the remaining are supplied by the lateral plantar nerve

  1.Abductor hallucis

  2.Flexor digitorum brevis

  3.First lumbrical

  4.Flexor hallucis brevis

- Tibial nerve → 1. Posterior compartment of thigh

  2. Posterior compartment of leg

  MPN LPN

  3. muscles of foot

  Motor supply

Cutaneous branches of tribal nerve 00:40:35

- Lateral plantar nerve → Lateral 1½ digits
- Medial plantar nerve →Medial 3½ digits
- Sensory supply of tibial nerve
- Plantar surface

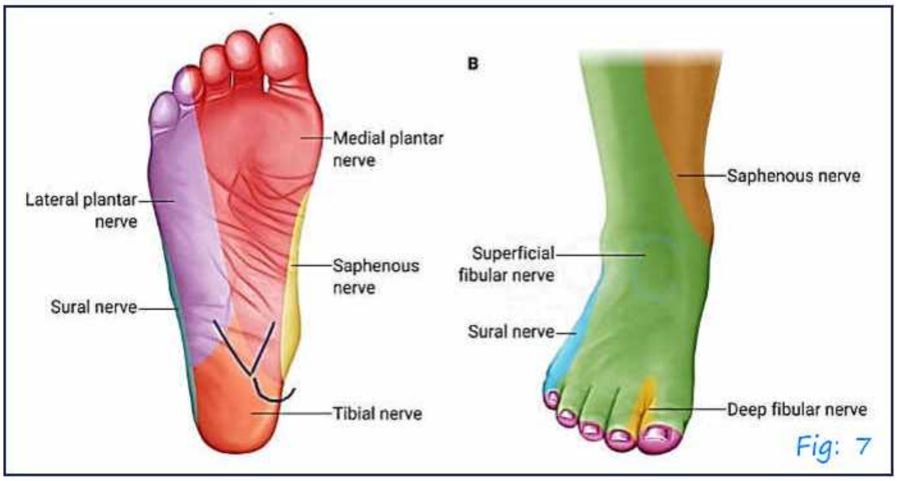

Lateral plantar nerve
Medial plantar nerve
Saphenous nerve
Sural nerve
Tibial nerve
B
Saphenous nerve
Superficial fibular nerve
Sural nerve
Deep fibular nerve

Fig: 7

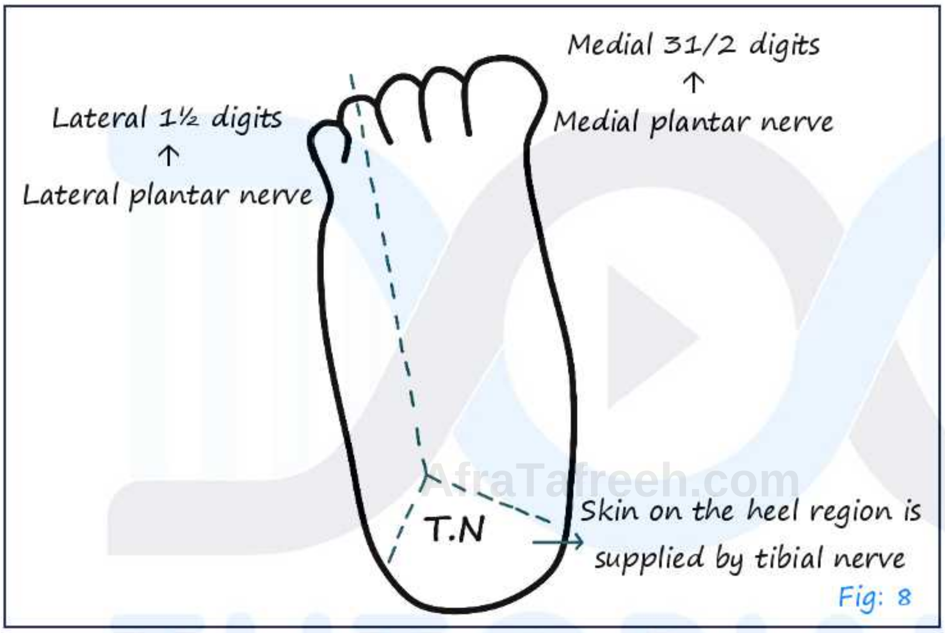

Medial 31/2 digits
↑
Medial plantar nerve
Lateral 1½ digits
↑
Lateral plantar nerve
T.N
Skin on the heel region is supplied by tibial nerve

Fig: 8

- Tibial nerve also gives a cutaneous branch → Sural nerve

Sural nerve 00:42:51

- Supplies to the skin on the lateral side of leg and the foot

FEMORAL NERVE

- Origin: Posterior division of L_2, L_3 and L_4
- Supplies to: Anterior compartment of thigh:

↓

1. Sartorius/ tailors/ honeymoon muscle (longest)
2. Quadriceps femoris
3. Pectineus muscle (lateral half)
   - Longest muscle in the body is sartorius or tailor's or the honeymoon muscle
   - Quadriceps femoris has 4 heads:
     - Vastus lateralis
     - Vastus medialis
     - Vastus intermedius
     - Rectus femoris

- Pectineus – composite muscle
- Femoral nerve also supplies to the iliacus muscle in the iliac fossa
- Sensory branches:

1. Saphenous nerve (cutaneous branch) – supplies to the skin on the medial side of leg and foot upto the great toe
   - Skin on the lateral side of the leg and food is supplied by the **sural nerve**, which is a branch of the tibial nerve

Longest cutaneous branch in the body is saphenous nerve

TUTORIALS LOGIN FOR SUCCESS

2. Medial cutaneous nerve of thigh
3. Intermediate cutaneous nerve of thigh

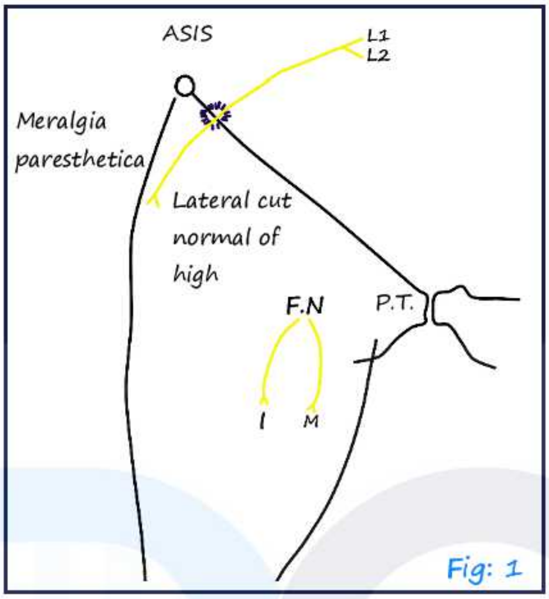

ASIS
L1
L2
Meralgia
paresthetica
Lateral cut
normal of
high
F.N
P.T.
I
M

Fig: 1

- Lateral cutaneous nerve of thigh comes from L_2 and L_3. It usually goes above the inguinal ligament but in some cases, it goes beneath the inguinal ligament where it might get compressed → known as **meralgia paresthetica**
- Meralgia paresthetica – compression of lateral cutaneous nerve of thigh beneath the inguinal ligament

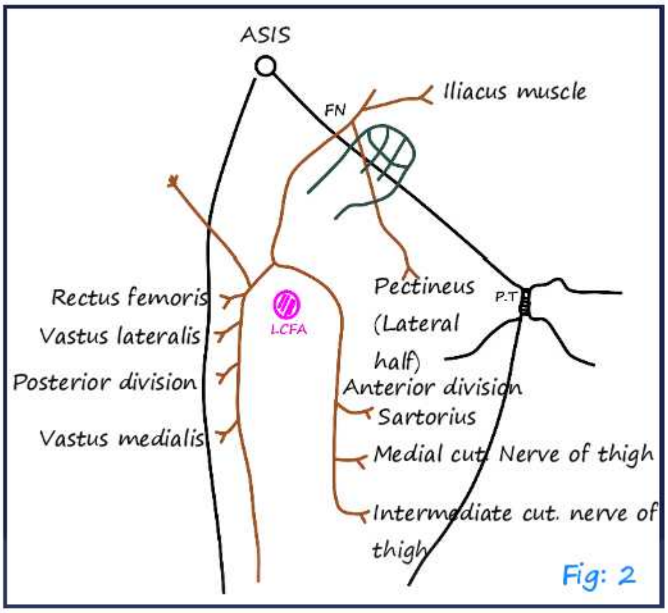

ASIS
FN
Iliacus muscle
Rectus femoris
Vastus lateralis
Posterior division
Vastus medialis
LCFA
Pectineus (Lateral half)
P.T
Anterior division
Sartorius
Medial cut. Nerve of thigh
Intermediate cut. nerve of thigh

Fig: 2

Saphenous nerve – skin on medial side of leg and foot up to great toe

- Femoral sheath is divided into 3 compartments.
- Femoral nerve does not pass through the femoral sheath, it is outside.
- Lateral circumflex artery divides the femoral nerve into anterior division and the posterior division.

Anterior division

- Supplies to sartorius
  - Medial cutaneous nerve of thigh ⎤ Sensory
  - Intermediate cutaneous nerve of thigh ⎦ branches

Posterior division

- 4 heads of quadriceps femoris

  1.Rectus femoris

2.Vastus lateralis

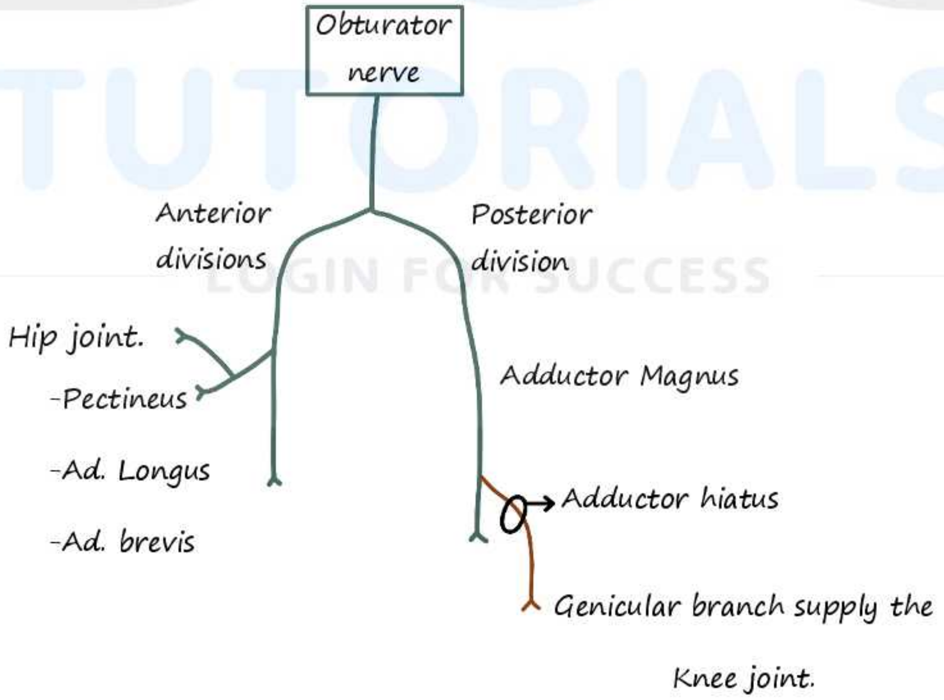
3.Vastus intermedius

4.Vastus medialis

- It gives saphenous nerve (longest cutaneous branch) which supplies to skin on medial side of the leg and foot upto the great toe.
- Nerve to rectus femoris also gives a branch which will supply to the hip joint.
- Pain from hip is referred to the medial side of the leg and foot because of **femoral nerve.**

OBTURATOR NERVE

- Origin: Anterior division of L_2, L_3 and L_4
- Supplies to medial compartment of thigh
  - Adductor longus
  - Adductor brevis
  - Adductor magnus (Adductor part)
  - Pectineus muscle (medial half)
  - Gracilis muscle or antirape muscle
  - Obturator externus muscle
- Superficial group – Pectineus and adductor longus
- Middle – Adductor brevis
- Deep – Adductor magnus


Obturator nerve
Anterior divisions
Posterior division
Hip joint.
-Pectineus
-Ad. Longus
-Ad. brevis
Adductor Magnus
Adductor hiatus
Genicular branch supply the Knee joint.

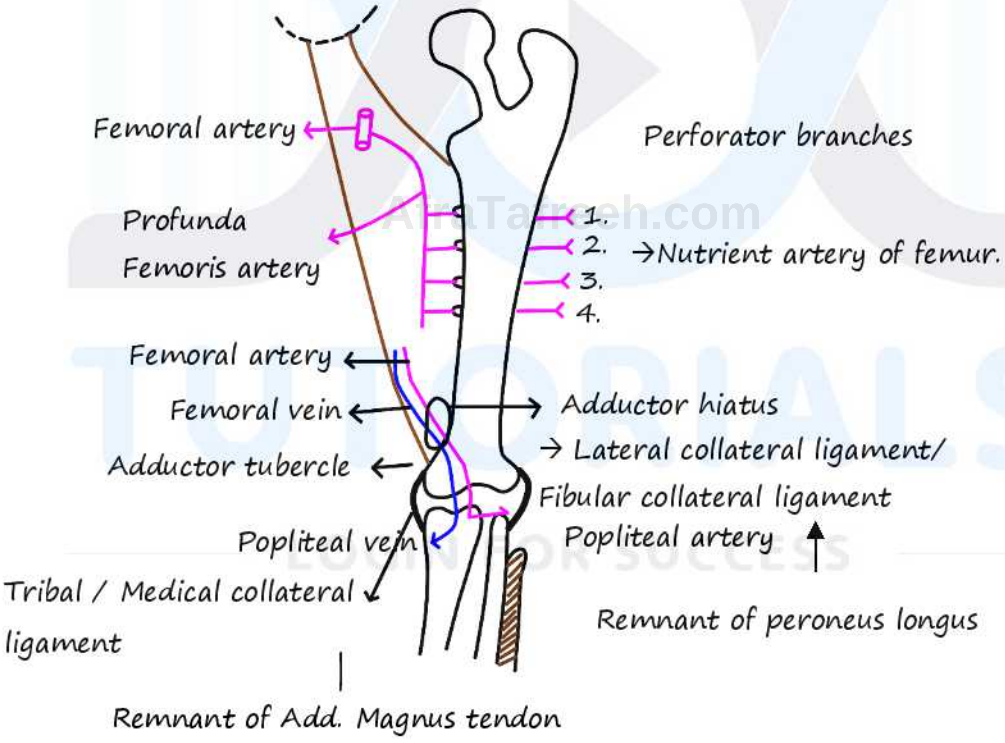
- Any pain in the knee joint is referred to the hip joint via obturator nerve and vice-versa.

Hip joint $\xleftrightarrow[\text{Referred pain}]{\text{Obturator nerve}}$ knee joint

- The referred pain from the hip joint will go to the medial aspect of the leg and foot via femoral nerve.

Adductor magnus muscle 00:08:32

- Origin: Ischium
- Insertion: Linea aspera of femur


Femoral artery
Perforator branches
Profunda Femoris artery
1.
2.
→Nutrient artery of femur.
3.
4.
Femoral artery
Femoral vein
Adductor hiatus
Adductor tubercle
→ Lateral collateral ligament/ Fibular collateral ligament
Popliteal vein
Popliteal artery
Tribal / Medical collateral ligament
Remnant of peroneus longus
Remnant of Add. Magnus tendon

- Branch of femoral artery called the profunda femoris artery which further gives branches that go behind the posterior aspect of the thigh via the perforations called the perforator branches.

- The second perforator branch is the nutrient artery of femur

---

Structures passing through the adductor hiatus

00:14:10

- Femoral artery
- Femoral vein
- Genicular branches of obturator nerve
  - Medial or tibial collateral ligament is the remnant of adductor magnus tendon
  - Lateral or fibular collateral ligament is the remnant of peroneus longus

FEMORAL TRIANGLE; F. SHEATH;
F. CANAL AND F. RING

Femoral Triangle 00:00:47

- Present in the upper 1/3rd of the anterior aspect of the thigh.

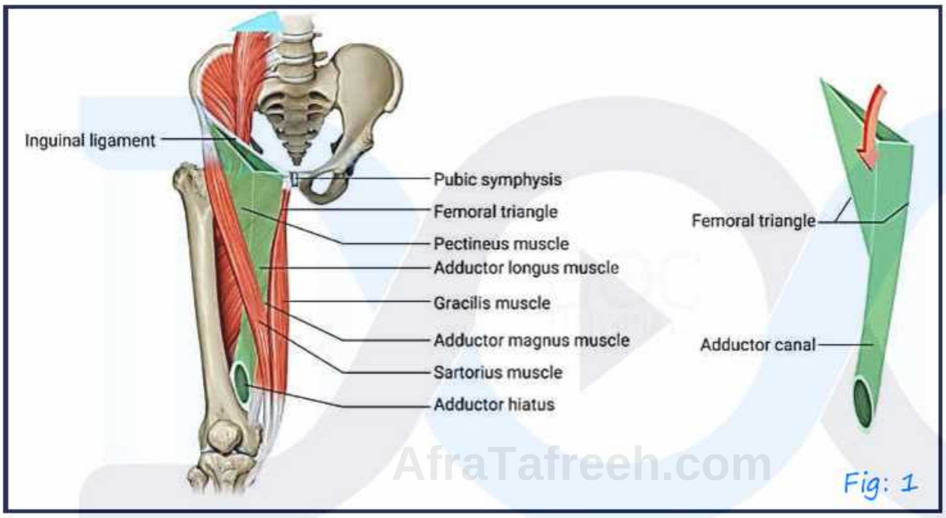

Inguinal ligament
Pubic symphysis
Femoral triangle
Pectineus muscle
Adductor longus muscle
Gracilis muscle
Adductor magnus muscle
Sartorius muscle
Adductor hiatus
Femoral triangle
Adductor canal

Fig: 1

DOC TUTORIALS LOGIN FOR SUCCESS

Boundaries

- Base → Inguinal ligament
- Laterally → Medial border of sartorius
- Medially → Medial border of adductor longus

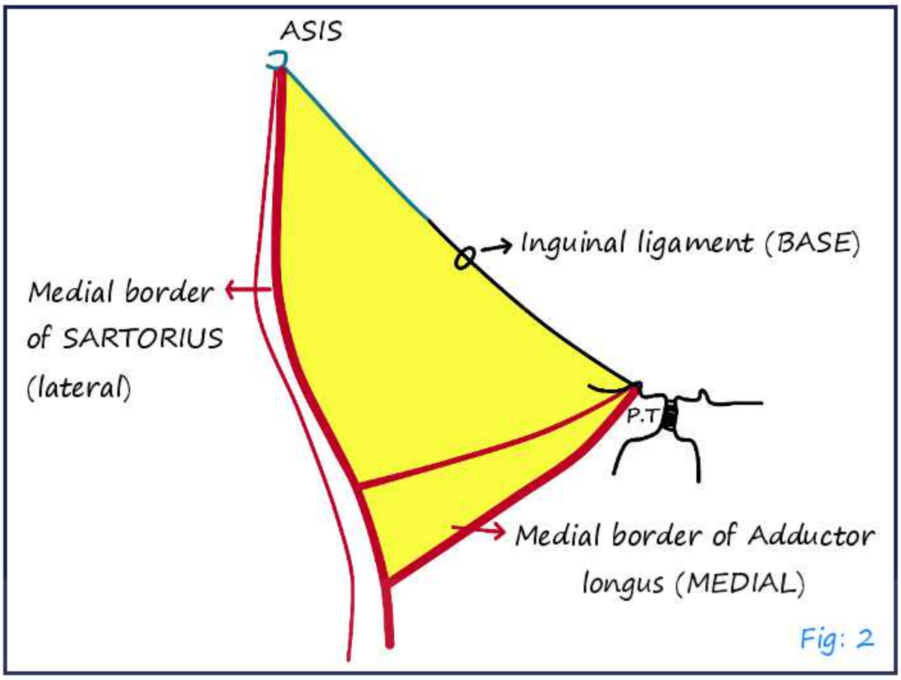

ASIS
Inguinal ligament (BASE)
Medial border of SARTORIUS (lateral)
P.T
Medial border of Adductor longus (MEDIAL)

Fig: 2

Floor

i. Iliacus

ii. Psoas major

iii. Pectineus

iv. Adductor longus

TUTORIALS LOGIN FOR SUCCESS

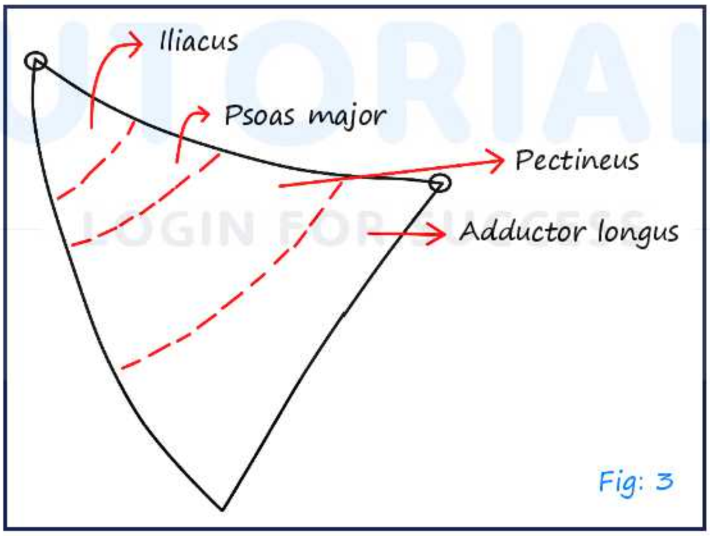

Iliacus
Psoas major
Pectineus
Adductor longus

Fig: 3

Roof

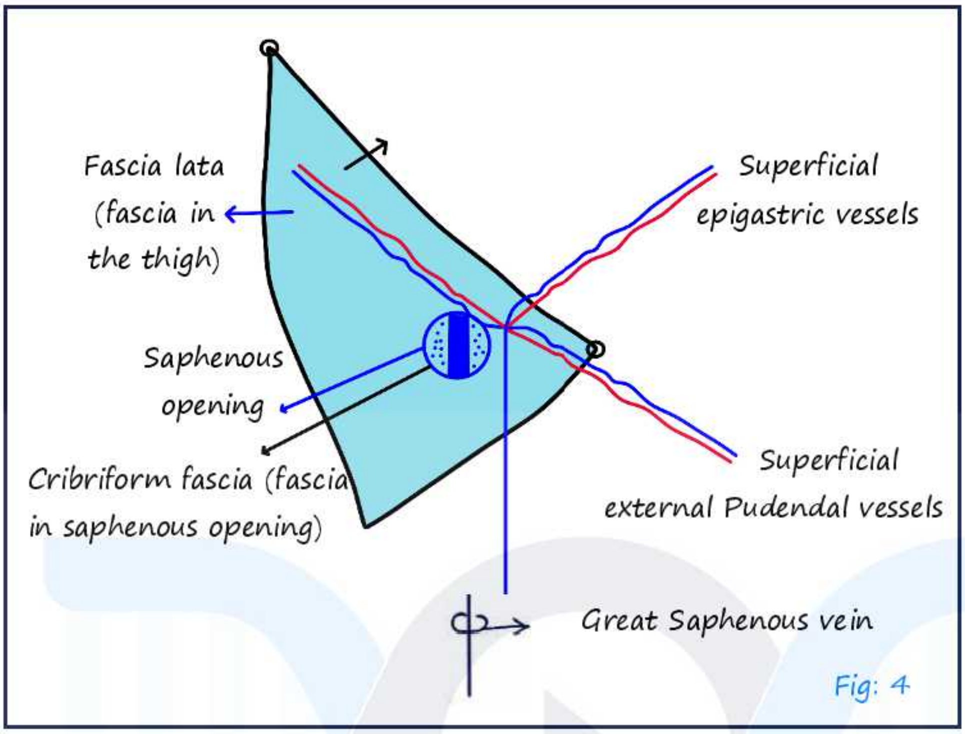
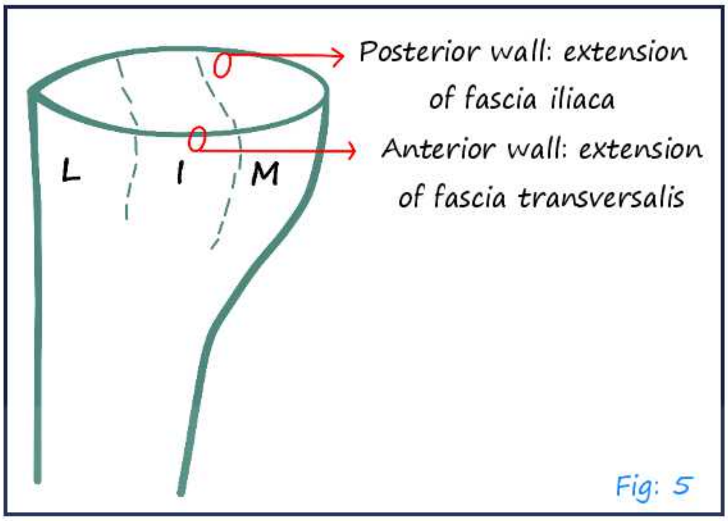

Fascia lata
(fascia in
the thigh)
Saphenous
opening
Cribriform fascia (fascia
in saphenous opening)
Superficial
epigastric vessels
Superficial
external Pudendal vessels
Great Saphenous vein

Fig: 4

Contents – VAN (Medial → lateral)

- Femoral activity
- Femoral vein
- Femoral nerve
- Lymph node

Femoral Sheath 00:18:38

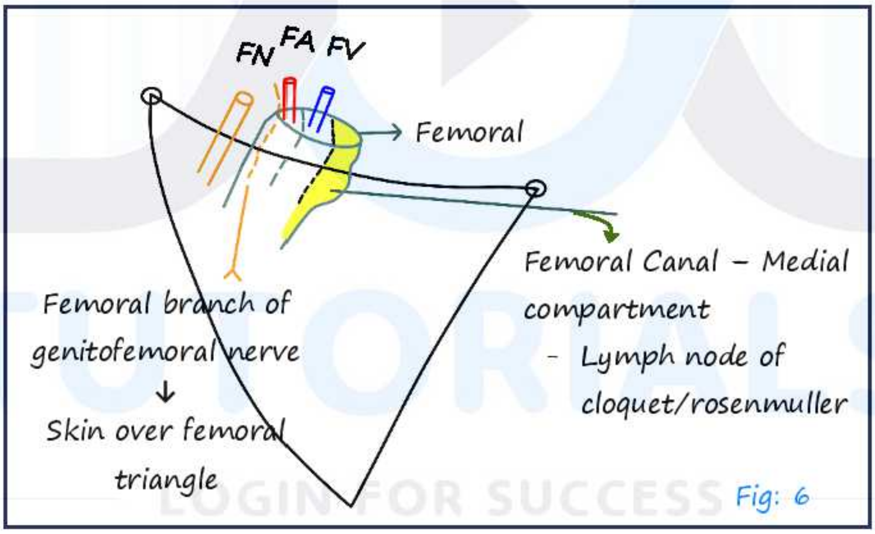


Posterior wall: extension of fascia iliaca

Anterior wall: extension of fascia transversalis

Fig: 5

- Femoral nerve is not a content of femoral sheath



Femoral Canal – Medial compartment
- Lymph node of cloquet/rosenmuller

Femoral branch of genitofemoral nerve
↓
Skin over femoral triangle

Fig: 6

Femoral sheath

Lateral compartment
- Femoral artery
- Femoral branch of Genitofemoral branch

Intermediate compartment
- Femoral vein

Medial compartment
Femoral canal
- Lymph nodes of CLOQUET/ROSEN MULLER

TUTORIALS LOGIN FOR SUCCESS

- Femoral nerve does not pass-through femoral sheath, it is outside.
- Lymph node of cloquet/Rosenmuller

Males	**Females**
- Drain lymph from glans penis	- Drain lymph from clitoris

Femoral Ring 00:29:37

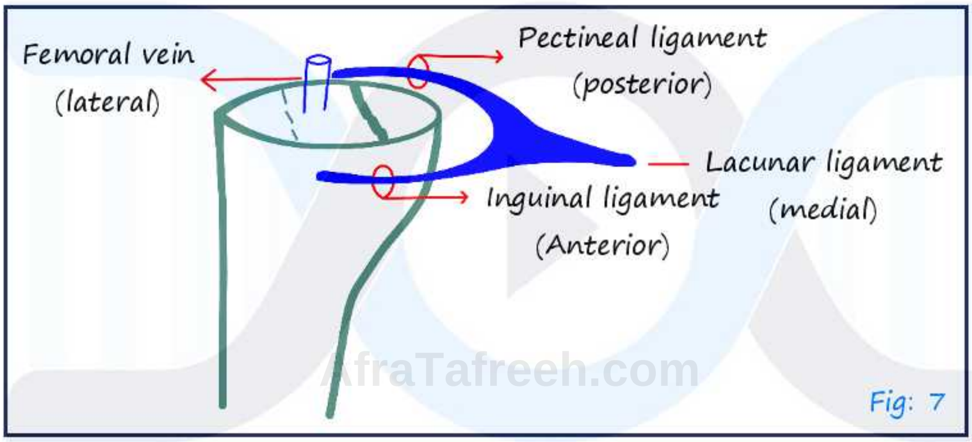

Femoral vein
(lateral)
Pectineal ligament
(posterior)
Lacunar ligament
(medial)
Inguinal ligament
(Anterior)

Fig: 7

Boundaries

i. Anterior → Inguinal ligament
ii. Posterior → pectineal ligament
iii. Medially → Lacunar ligament
iv. Laterally → Femoral vein

- Femoral hernia → most commonly seen in females.
  ↓
  Occurs in the femoral canal

ADDUCTOR CANAL

Adductor Canal/Subsartorial Canal/Hunter's Canal

00:00:10

- **Boundaries:** - Femoral triangle continues as Adductor canal.

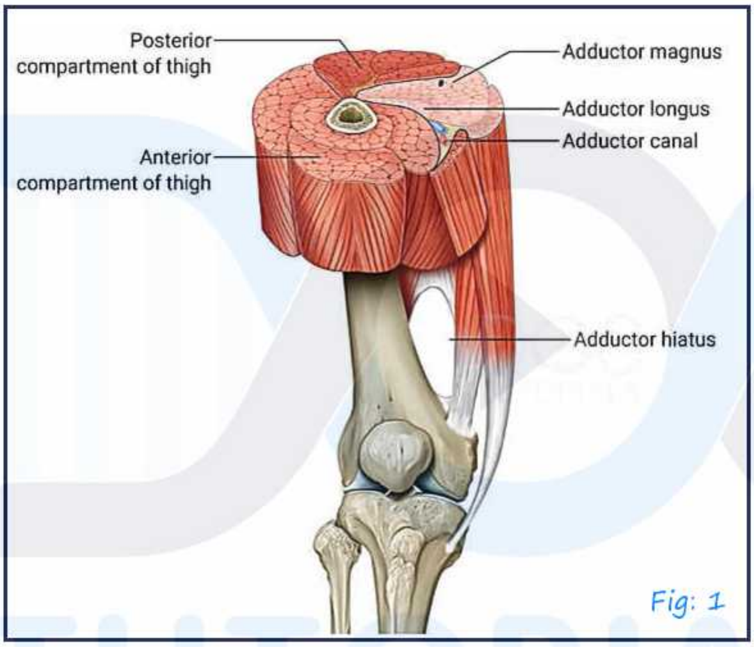

Posterior compartment of thigh
Anterior compartment of thigh
Adductor magnus
Adductor longus
Adductor canal
Adductor hiatus

Fig: 1

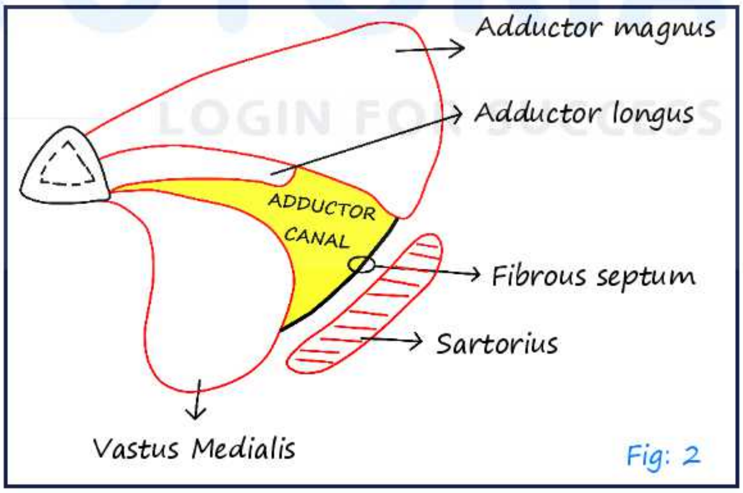

Adductor magnus
Adductor longus
ADDUCTOR CANAL
Fibrous septum
Sartorius
Vastus Medialis

Fig: 2

- Adductor Magnus & Adductor Longus
- Fibrous septum
- Vastus Medialis

Contents

- Femoral vein
- Femoral artery
- Saphenous nerve
- Nerve to vastus medialis

GLUTEAL REGION, GREATER AND LESSER SCIATIC FORAMEN

Gluteal Region 00:00:56

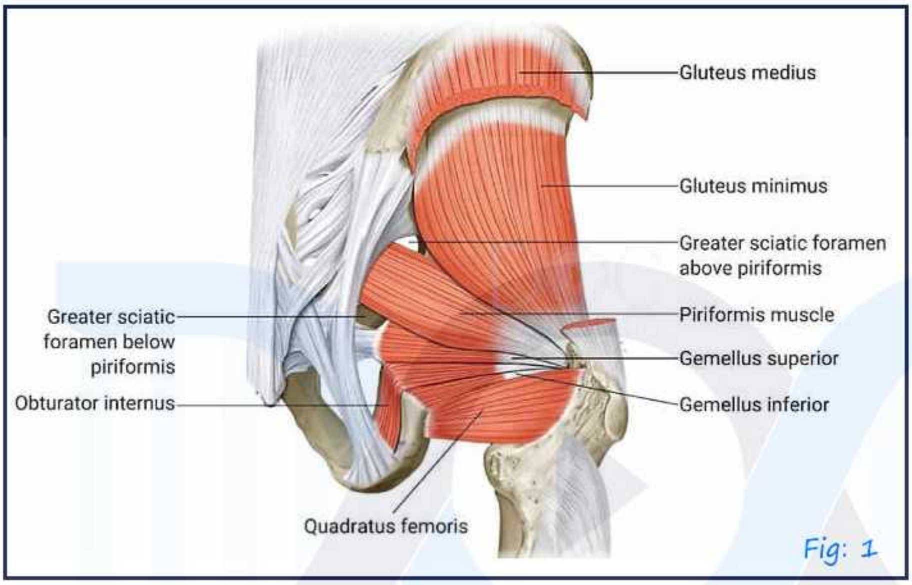

Gluteus medius
Gluteus minimus
Greater sciatic foramen above piriformis
Piriformis muscle
Gemellus superior
Gemellus inferior
Greater sciatic foramen below piriformis
Obturator internus
Quadratus femoris

Fig: 1

- Gluteus Maximus → largest muscle in the body

Gluteal region		
Muscle	**Nerve Supply**	**Action**
1. Gluteus Maximus (largest)	Inferior Gluteal Nerve ($L_5S_1S_2$)	- Extension at hip joint
2. Gluteus medius	Superior Gluteal Nerve ($L_4L_5S_1$) ↓ Injury TRENDELBURG sign (+) (Lurching gait) • Sartorius → longest muscle	- Abduction at hip joint and stabilizes the pelvis while walking
3. Gluteus minimus		

4. Gemellus superior	Nerve to obturator internus	Lateral Rotation of hip joint
5. Obturator internus		
6. Gemellus inferior	Nerve to Quadratus femoris	
7. Quadratus femoris		

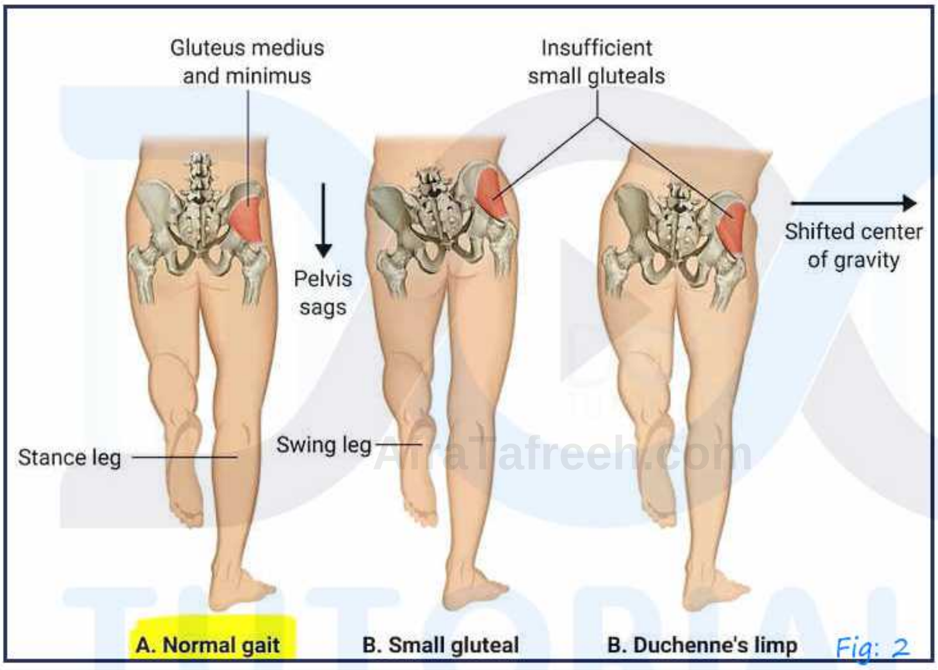

Gluteus medius and minimus
Insufficient small gluteals
Pelvis sags
Shifted center of gravity
Stance leg
Swing leg
A. Normal gait
B. Small gluteal
B. Duchenne's limp

Fig: 2

Structures Passing Through Greater Sciatic Foramen 00:16:58

- Above Piriformis: Superior Gluteal N, A, V
- Below piriformis: -
  - Inferior Gluteal N, A, V
  - Nerve to obturator internus
  - Nerve to quadratus femoris
  - Sciatic nerve } +
  - Posterior cutaneous nerve of thigh

- Pudendal nerve
- Internal pudendal artery & vein
- Nerve to obturator internus.

Structures Passing Through Lesser Sciatic Foramen

00:27:07

- Pudendal nerve
- Internal pudendal artery and vein.
- Obturator internus tendon.

ILIOTIBIAL TRACT

[FASCIA OF THIGH FASCIA LATA]

Iliotibial Tract 00:00:16

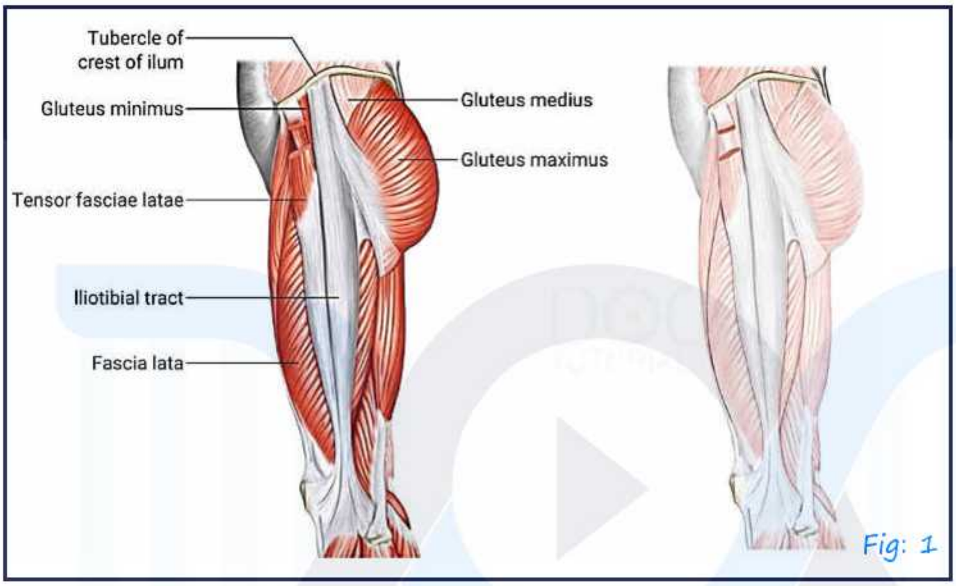

Tubercle of crest of ilum
Gluteus minimus
Tensor fasciae latae
Iliotibial tract
Fascia lata
Gluteus medius
Gluteus maximus

Fig: 1

- Condensed Fascia lata

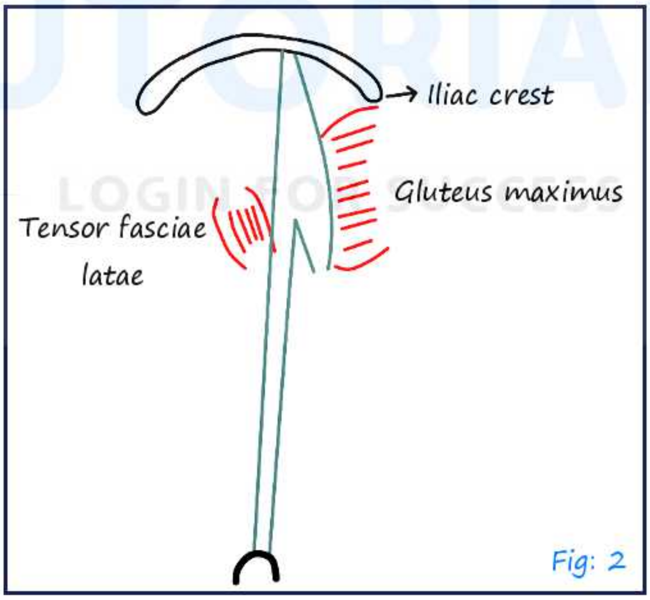

Iliac crest
Gluteus maximus
Tensor fasciae latae

Fig: 2

- Gletus Maximus and tensor latae get inserted into the Iliotibial tract.

Superior Gluteal Nerve

- Gluteus Medius
- Gluteus Minimus
- Tensor fasciae latae.

Inferior Gluteal Nerve

- Gluteus Maximus

VESSELS OF LOWER LIMB AND POPLITEAL FOSSA

Anastomoses at the Back of the Thigh 00:00:40

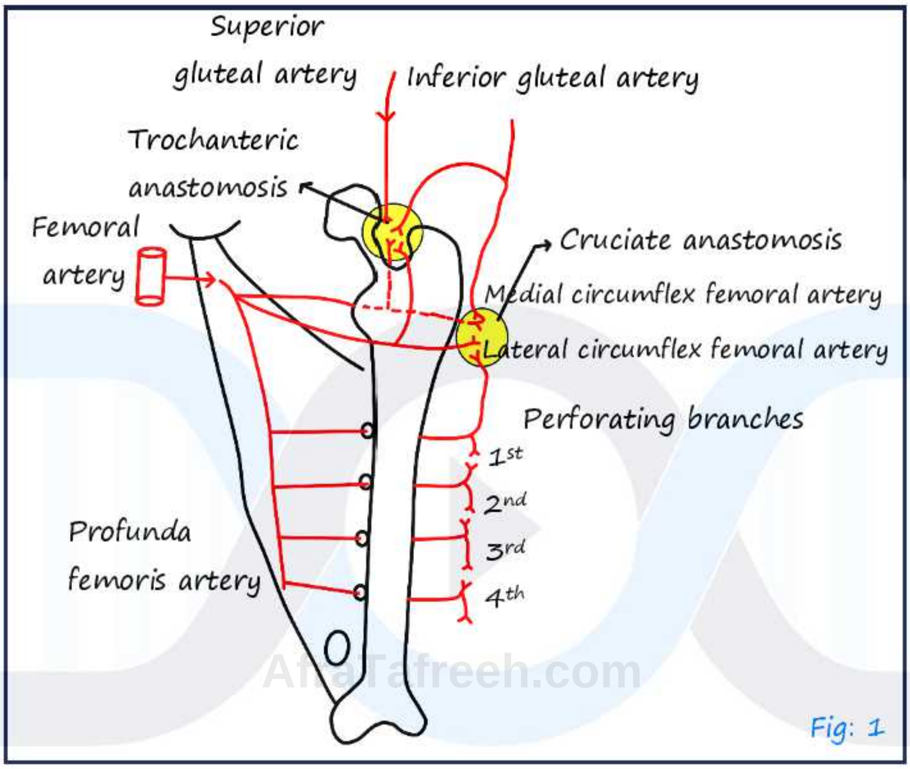

Superior
gluteal artery
Inferior gluteal artery
Trochanteric
anastomosis
Femoral
artery
Cruciate anastomosis
Medial circumflex femoral artery
Lateral circumflex femoral artery
Perforating branches
1st
2nd
3rd
4th
Profunda
femoris artery

Fig: 1

DOT TUTORIALS
LOGIN FOR SUCCESS

- Plantaris muscle has the longest tendon in the entire body

Cruciate Anastomosis

1. Inferior Gluteal artery (above)
2. First perforating branch (above)
3. Medial circumflex femoral artery.
4. Lateral circumflex femoral artery.

Trochanteric Anastomosis

1. Branch from inferior gluteal artery.

2. Branch from medial circumflex femoral artery.
3. Branch from lateral circumflex femoral artery.
4. Superior gluteal artery

Popliteal Fossa 00:09:20

Boundaries

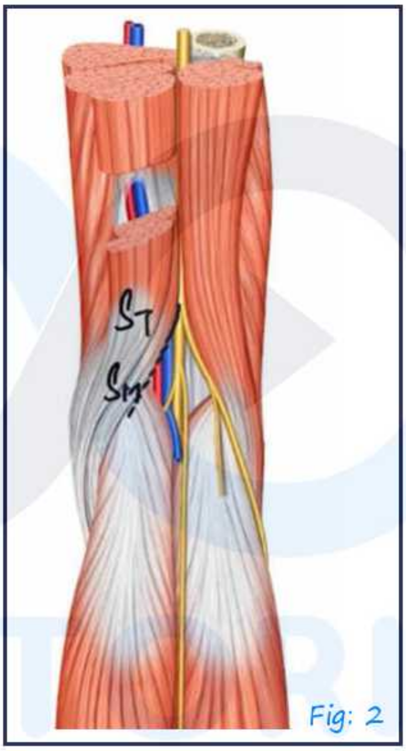


Fig: 2

DOCTUTORIALS LOGIN FOR SUCCESS

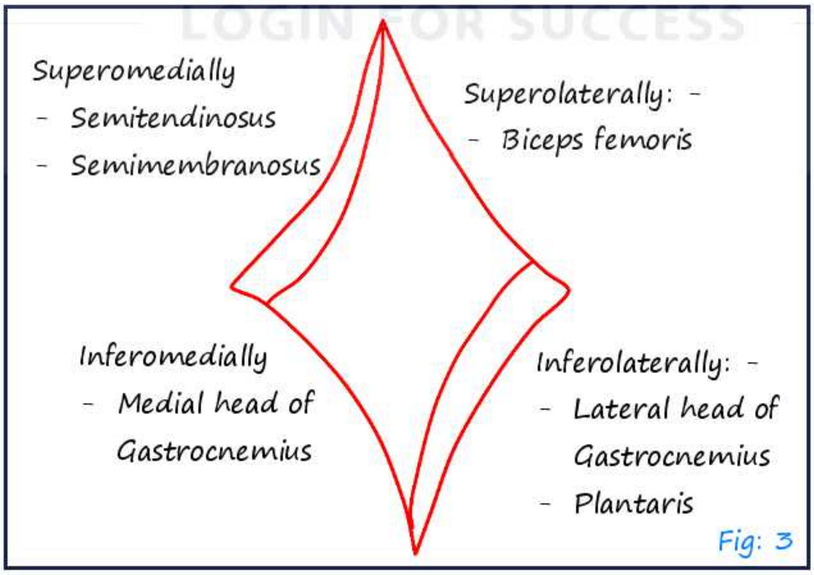

Superomedially
- Semitendinosus
- Semimembranosus
Superolaterally: -
- Biceps femoris
Inferomedially
- Medial head of Gastrocnemius
Inferolaterally: -
- Lateral head of Gastrocnemius
- Plantaris

Fig: 3

Floor

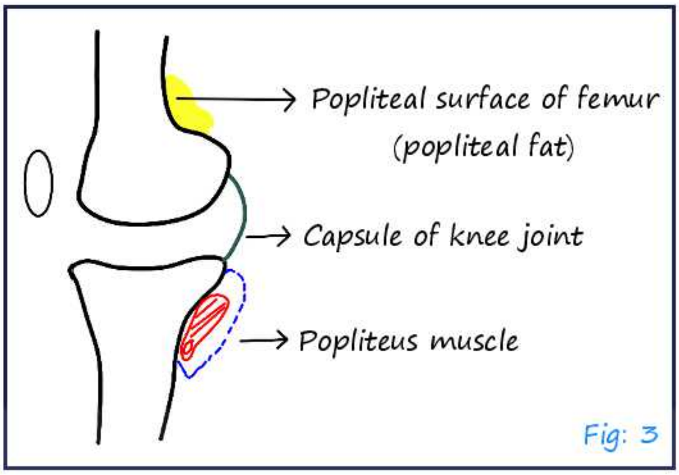

Popliteal surface of femur
(popliteal fat)
Capsule of knee joint
Popliteus muscle

Fig: 3

1. Popliteal surface of the femur. (Along with popliteal fat)
2. Capsule of knee joint
3. Popliteus muscle

Posterior surface

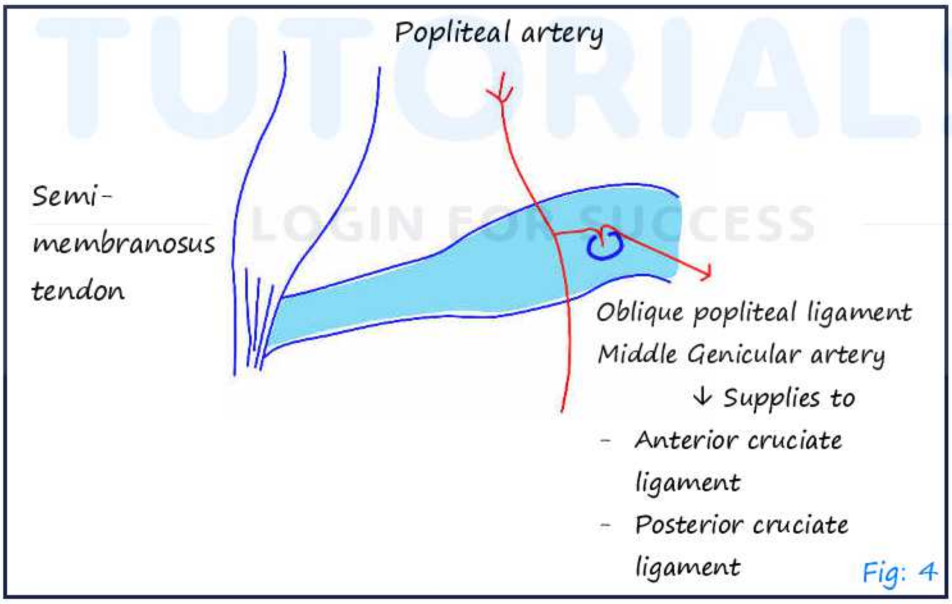

Popliteal artery
Semi-
membranosus
tendon
Oblique popliteal ligament
Middle Genicular artery
↓ Supplies to
- Anterior cruciate ligament
- Posterior cruciate ligament

Fig: 4

- Middle Genicular artery → pierces through the oblique popliteal ligament. It supplies to
  - Anterior cruciate ligament

- Posterior cruciate ligament

- Oblique popliteal ligament → Extension of semimembranosus tendon

Roof

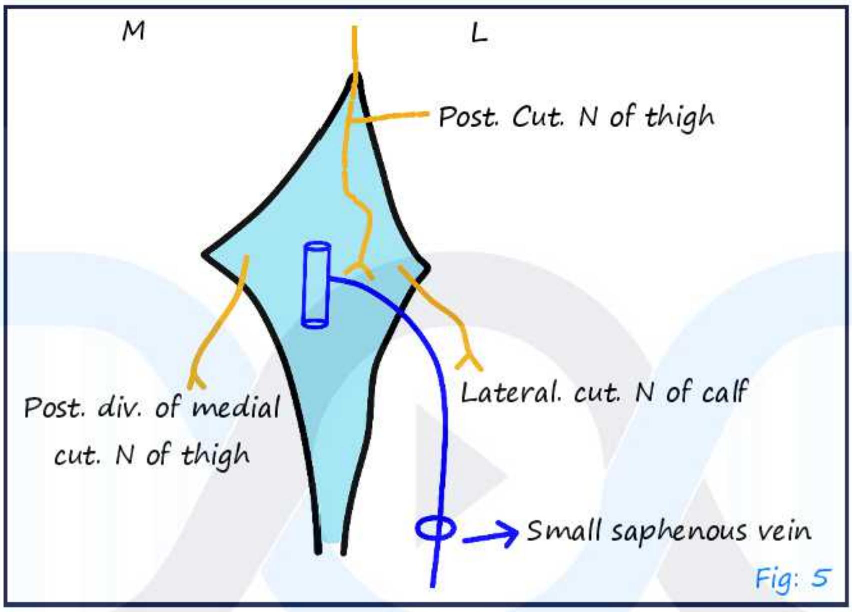

M
L
Post. Cut. N of thigh
Post. div. of medial cut. N of thigh
Lateral. cut. N of calf
Small saphenous vein

Fig: 5

1. Posterior cutaneous nerve of the thigh.
2. Posterior division of medial cutaneous nerve of the thigh.
3. Lateral cutaneous nerve of calf
4. Small saphenous vein.

Contents (Deep to superficial)

1. Popliteal artery
2. Popliteal vein
3. Sciatic nerve → Tibial nerve, → Common peroneal nerve
4. Posterior cutaneous nerve of thigh

ARCHES OF FOOT

Tarsal Bones 00:00:07

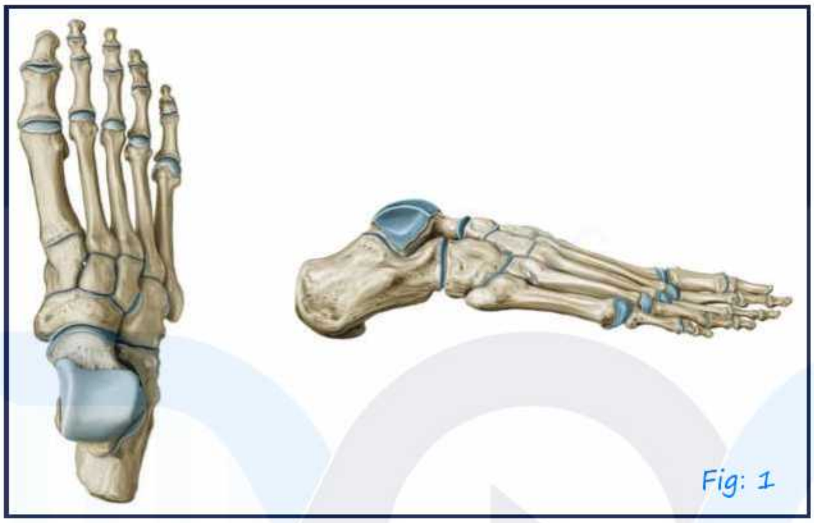


Fig: 1

1.Calcaneus

2.Talus

3.Navicular bone

4.Cuboid (lateral)

5.3 Cuneiform bones.

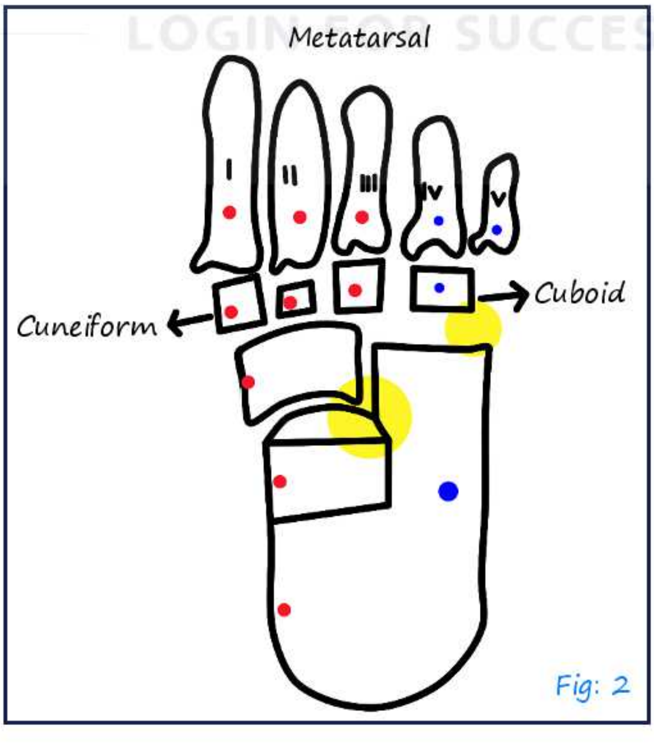

Metatarsal
I
II
III
IV
V
Cuneiform
Cuboid

Fig: 2

Medial and Lateral Longitudinal Arches 00:04:37

	Medial Longitudinal Arch	Lateral Longitudinal Arch
Bones	Calcaneus, Talus, Navicular, 3 Cuneiform, 1st, 2nd & 3rd Metatarsals.	Calcaneus, Cuboid, 4th & 5th Metatarsals
Summit	TALUS	CALCANEUS
Joint	Talocalcaneonavicular joint (Ball and socket joint)	Calcaneocuboid joint
Ligament	Spring ligament (plantar calceno-navicular ligament)	Short and long plantar ligaments
Sling	- Tibialis anterior - Tibialis posterior (major) - Flexor digitorum longus.	-Peroneus longus (major) -Peroneus brevis.
Tie – Beam	Plantar aponeurosis	Plantar aponeurosis

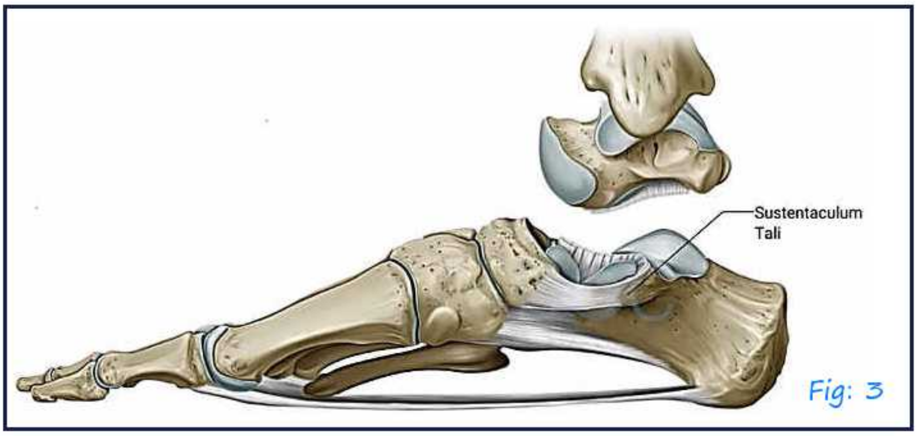


Fig: 3

PELVIS AND PERINEUM

Pelvis diaphragm 00:00:36

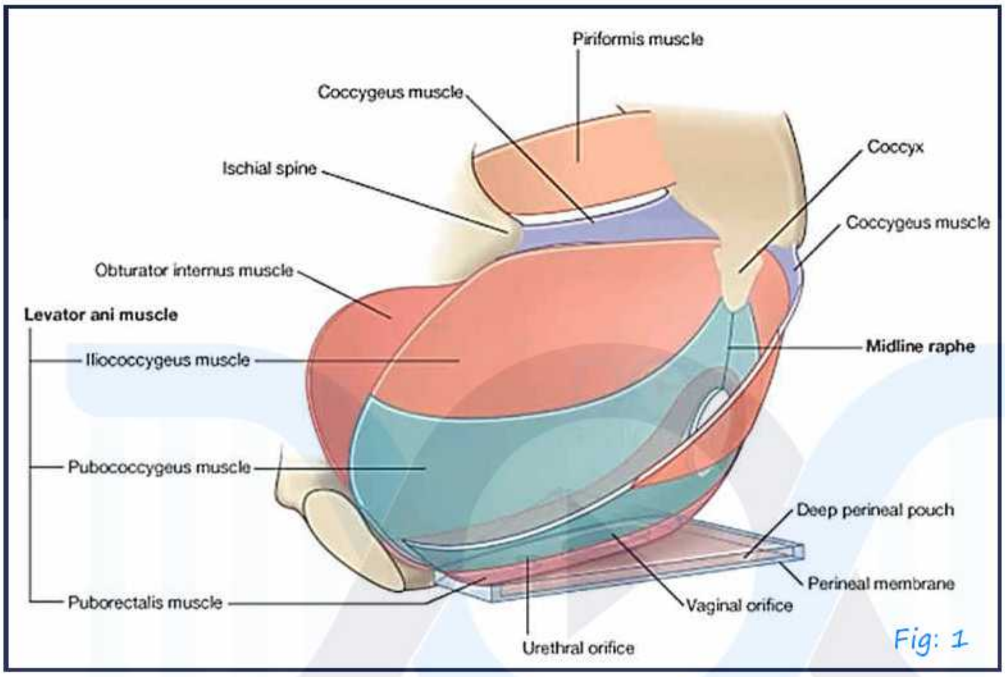

Piriformis muscle
Coccygeus muscle
Ischial spine
Coccyx
Coccygeus muscle
Obturator internus muscle
Levator ani muscle
Iliococcygeus muscle
Midline raphe
Pubococcygeus muscle
Deep perineal pouch
Perineal membrane
Puborectalis muscle
Vaginal orifice
Urethral orifice

Fig: 1

- 2 muscles
  - i. Levator anterior
    - Pubococcygeus
    - Iliococcygeus
  - ii. Coccygeus/ ischiococcygeus
    - Vestigial muscle in humans

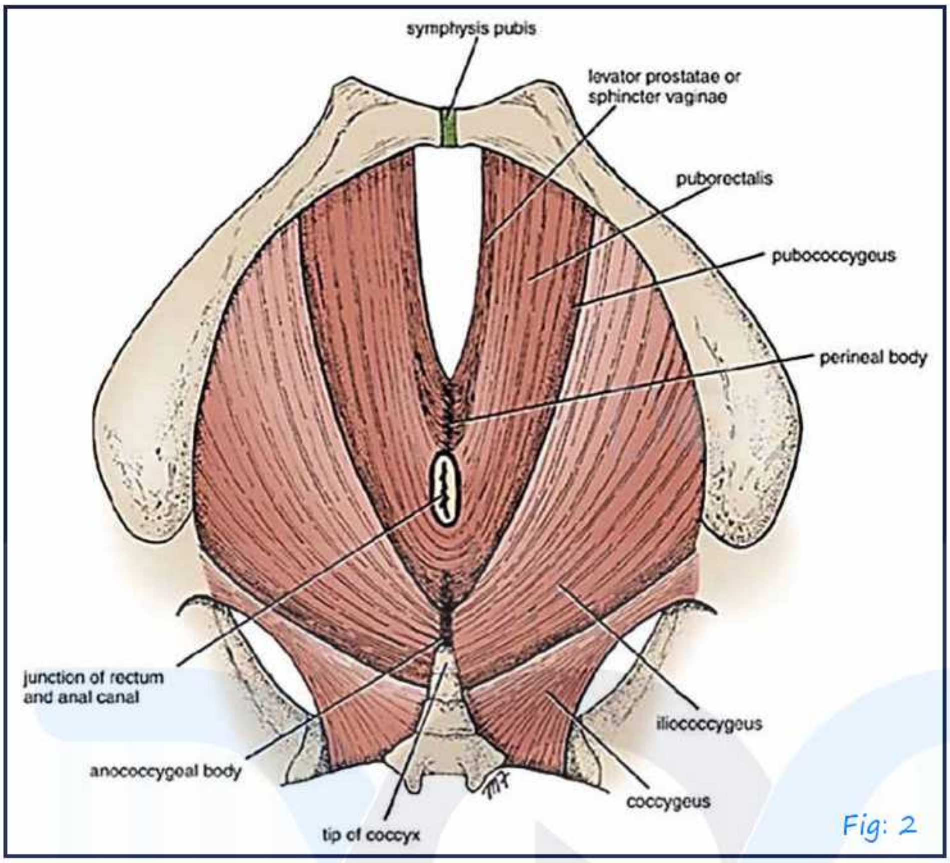

symphysis pubis
levator prostatae or sphincter vaginae
puborectalis
pubococcygeus
perineal body
junction of rectum and anal canal
iliococcygeus
anococcygeal body
coccygeus
tip of coccyx

Fig: 2

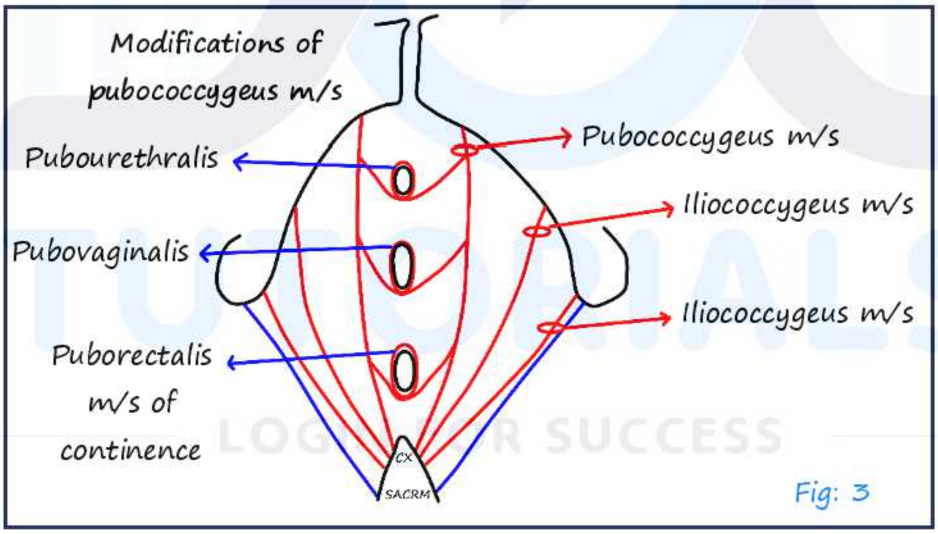

Modifications of pubococcygeus m/s
Pubourethralis
Pubococcygeus m/s
Iliococcygeus m/s
Pubovaginalis
Iliococcygeus m/s
Puborectalis m/s of continence
CX
SACRM

Fig: 3

TUTORIALS LOGIC FOR SUCCESS

- Modifications of pubococcygeus muscle

  1. Pubourethralis

  2. Pubovaginalis

  3. Puborectalis

- Puborectalis forms the Ano-rectal angle → muscle of continence

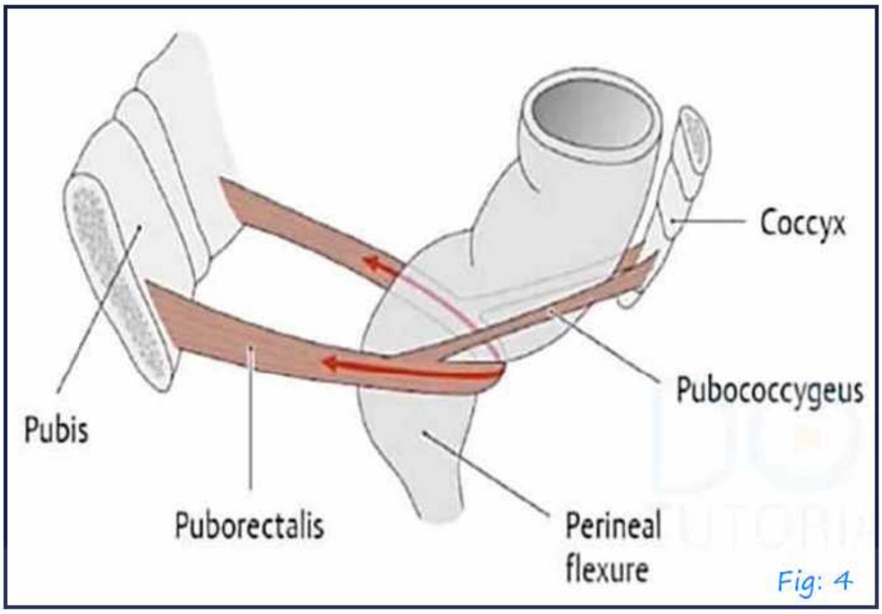

Coccyx
Pubococcygeus
Pubis
Puborectalis
Perineal flexure

Fig: 4

Urogenital diaphragm 00:17:26

1.External urethral sphincter muscle

2.Deep transverse perineal muscles

3.Superior fascia

4.Inferior fascia of UGD/ perineal membrane

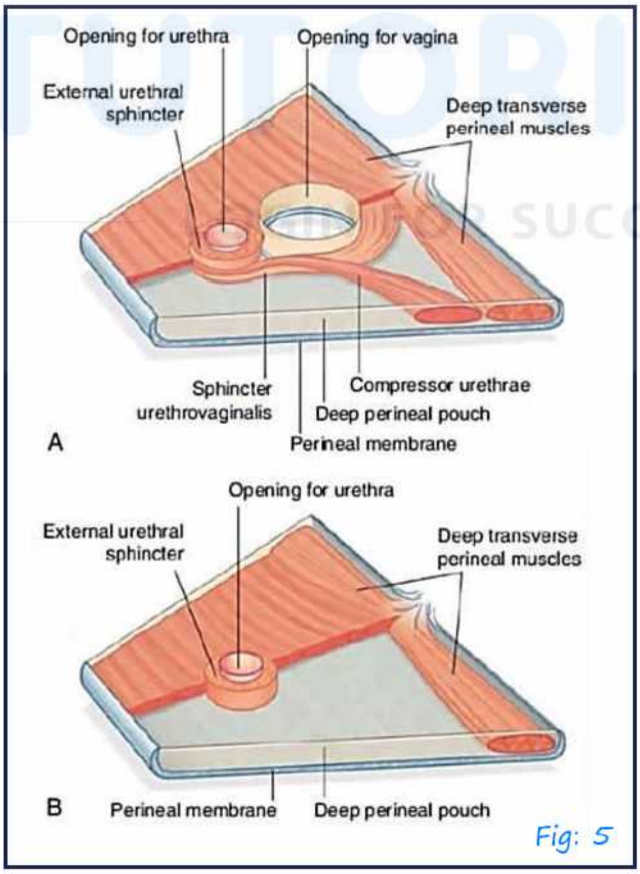

Opening for urethra
Opening for vagina
External urethral sphincter
Deep transverse perineal muscles
Sphincter urethrovaginalis
Compressor urethrae
Deep perineal pouch
Perineal membrane
A
Opening for urethra
External urethral sphincter
Deep transverse perineal muscles
B
Perineal membrane
Deep perineal pouch

Fig: 5

Perineal body 00:22:09

Perineal body: - 10 muscles

4 paired	2 paired
1. Bulbospongiosus	1. External anal sphincter
2. Superficial transverse perineal (STP)	2. Longitudinal muscles of anal canal
3. Deep transverse perineal (DTP)	
4. Levator Anterior	

- Rupture of perineal body in female → prolapse of pelvic viscera

TUTORIALS LOGIN FOR SUCCESS

Perineum 00:31:56

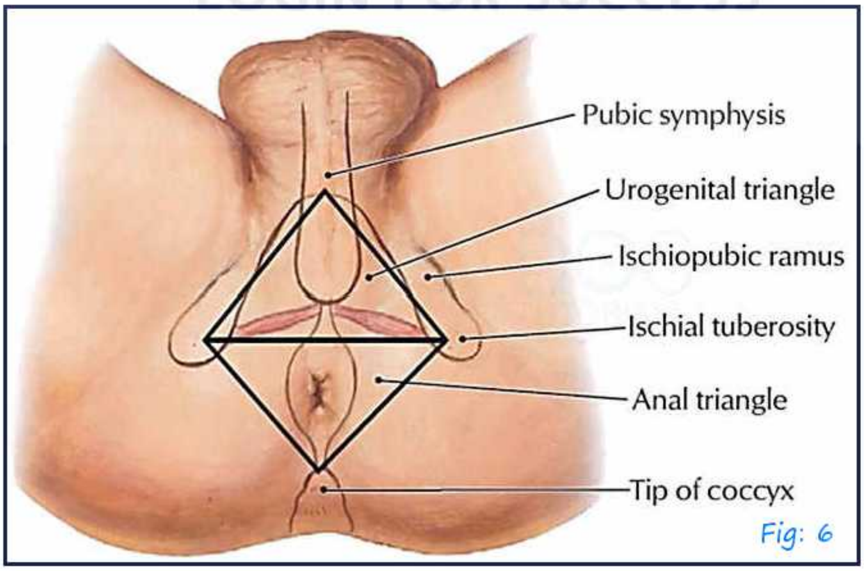

Pubic symphysis
Urogenital triangle
Ischiopubic ramus
Ischial tuberosity
Anal triangle
Tip of coccyx

Fig: 6

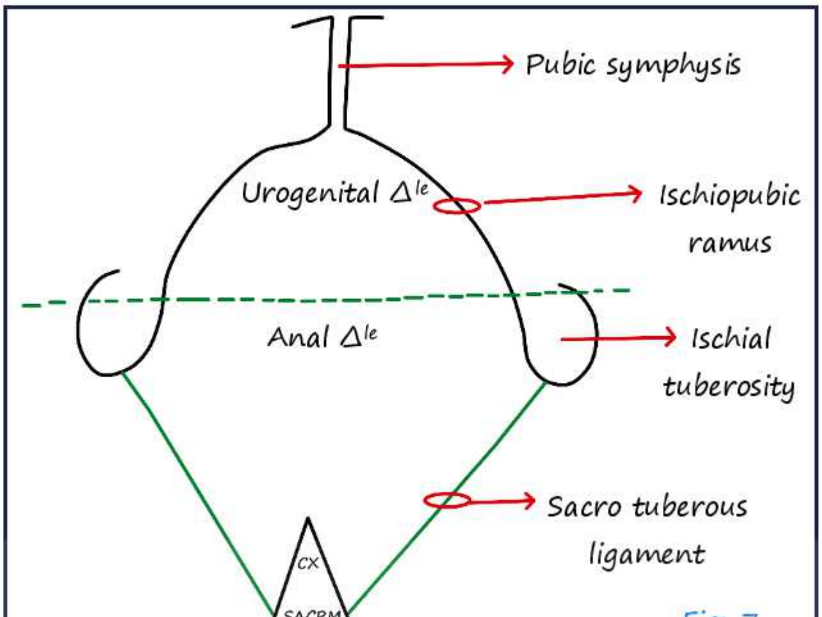
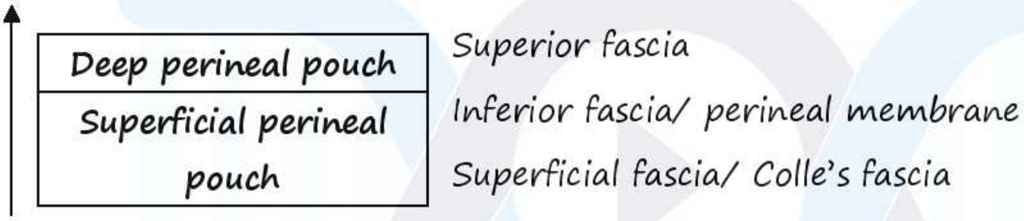

Pubic symphysis
Urogenital Δ^le
Ischiopubic ramus
Anal Δ^le
Ischial tuberosity
Sacro tuberous ligament
CX
SACRM

Fig: 7


Deep perineal pouch
Superficial perineal pouch
Superior fascia
Inferior fascia/ perineal membrane
Superficial fascia/ Colle's fascia

Deep perineal pouch 00:42:47

Boundaries

- Superiorly: Superior fascia of urogenital diaphragm (UGD)
- Inferiorly: Inferior fascia of UGD/ perineal membrane
- Laterally: Ischiopubic ramus

Contents

- External urethral sphincter
- Deep transverse perineal muscle (DTP)
- Membranous urethra in male
- Bulbourethral gland of Cowper in male

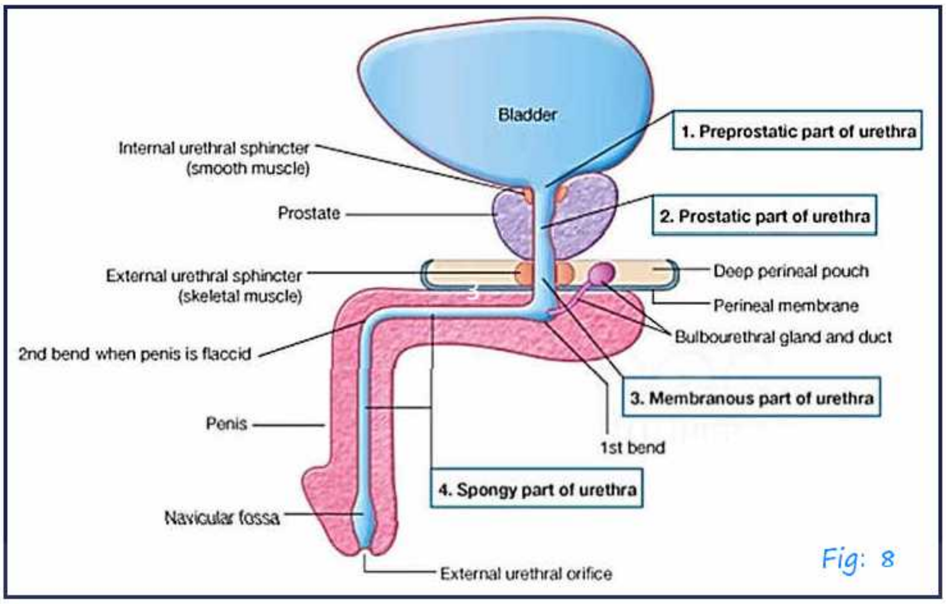

Bladder
Internal urethral sphincter (smooth muscle)
Prostate
External urethral sphincter (skeletal muscle)
2nd bend when penis is flaccid
Penis
Navicular fossa
External urethral orifice
1. Preprostatic part of urethra
2. Prostatic part of urethra
Deep perineal pouch
Perineal membrane
Bulbourethral gland and duct
3. Membranous part of urethra
1st bend
4. Spongy part of urethra

Fig: 8

Superficial perineal pouch 00:48:12

Boundaries

- Superiorly: Inferior fascia of UGD/ Perineal membrane
- Inferiorly: Superior fascia of perineum/ Colle's fascia
- Laterally: Ischiopubic ramus

Contents

- STP (Superficial Transverse Perineal) muscles
- Bulb/ Bulbospongiosus muscle
- Crus/ Ischiocarvernous muscle
- Greater vestibular gland/ Bartholin's gland in female

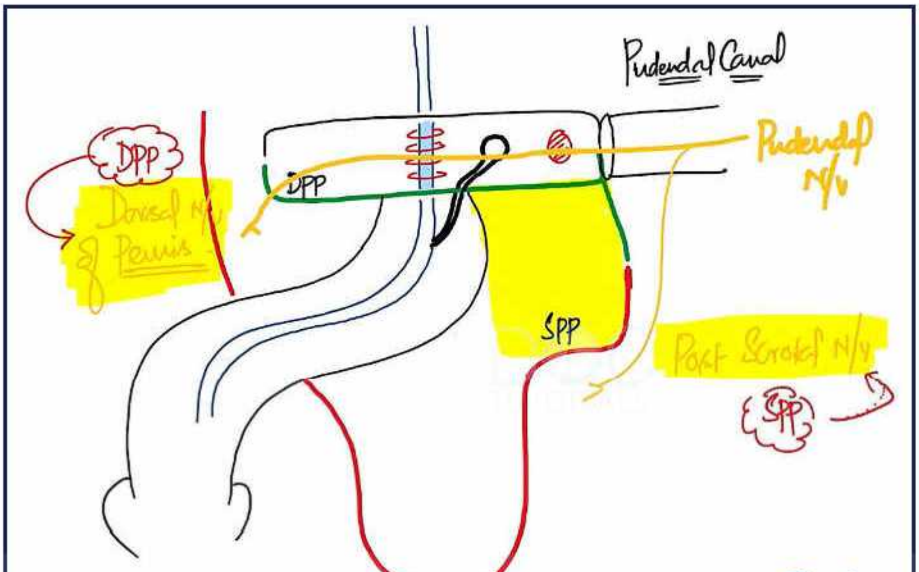

Pudendal Canal
DPP
Dorsal N/v of Penis
DPP
Pudendal N/v
SPP
Post Scrotal N/v
SPP

Fig: 9

Extravasation of urine 01:02:10

1. Membranous urethra $\xrightarrow{\text{rupture}}$ Urine in DPP
2. Penile urethra $\xrightarrow{\text{rupture}}$ Urine is seen in:
    - SPP
    - Scrotum
    - Thigh
    - Anterior abdominal wall upto axilla

ISCHIORECTAL FOSSA OR ISCHIOANAL FOSSA

Ischiorectal fossa or ischioanal fossa 00:00:07

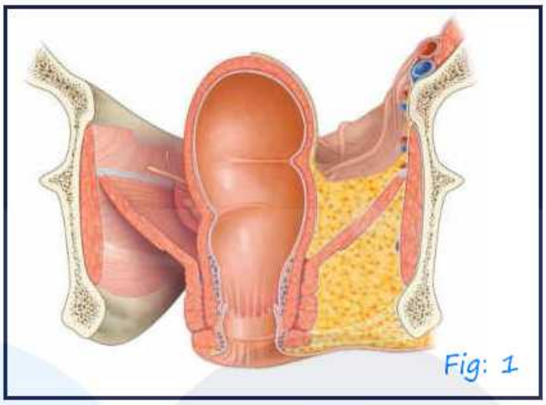


Fig: 1

Boundaries

- Laterally: Obturator internus muscle
- Medially: levator ani muscle
  - External anal sphincter
- Base: Skin of Gluteal region
- Anterior: Perineal membrane
- Posterior: Sacro tuberous ligament + Gluteus maximus

TUTORIALS LOGIN FOR SUCCESS

Content

- Fat
- Pudendal canal and its contents:
  - Pudendal nerve
  - Internal pudendal vessels (Artery & vein)
- Inferior rectal vessels and nerve

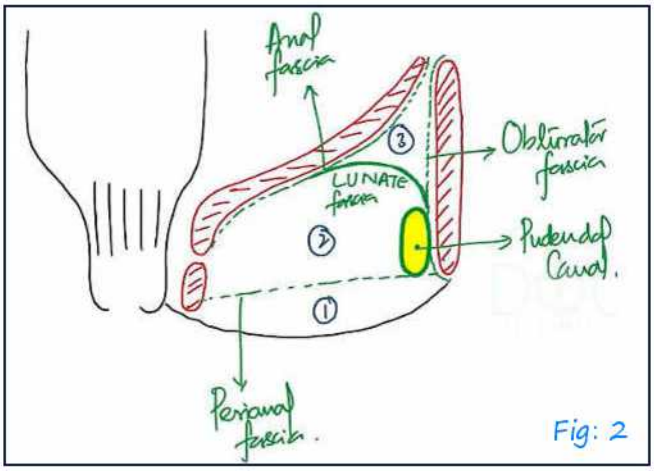

Anal fascia
③
LUNATE fascia
Obliterator fascia
②
Pudendal Canal.
①
Perianal fascia.

Fig: 2

1. Perianal space
2. IRF proper (Ischiorectal fossa proper)
3. Supra-tegmental space

INTERNAL ILIAC ARTERY

Internal iliac artery 00:00:22

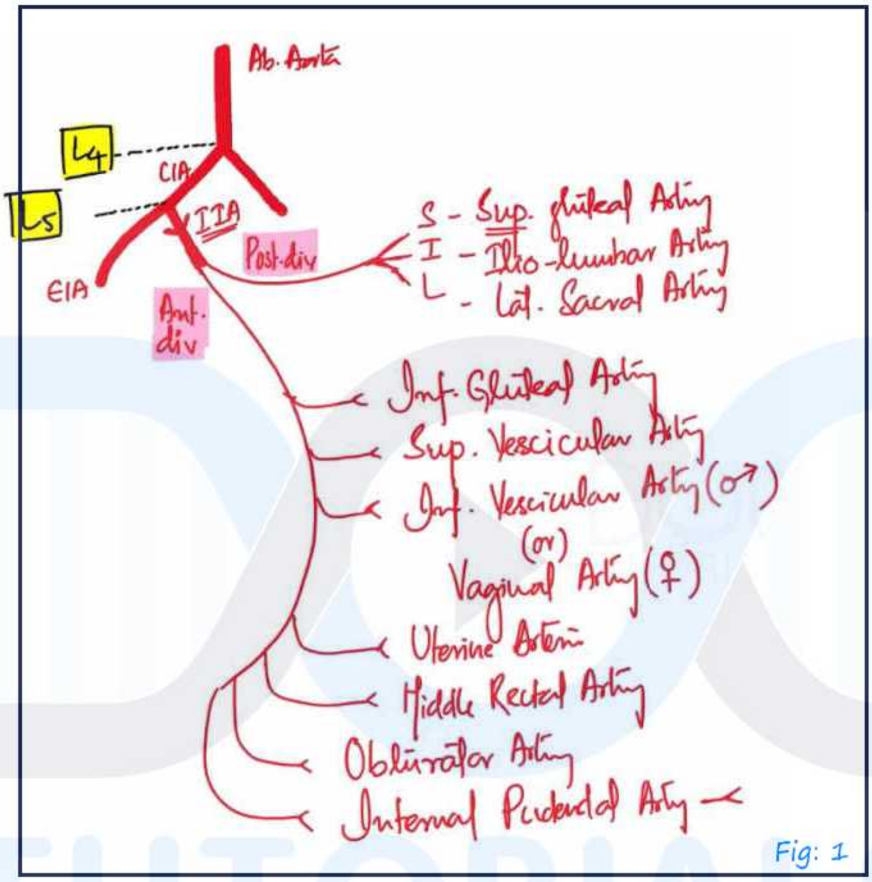

Ab. Aorta
L4
L5
CIA
IIA
EIA
Post. div
Ant. div
S - Sup. gluteal Artery
I - Ilio-lumbar Artery
L - Lat. Sacral Artery
Inf. Gluteal Artery
Sup. Vescicular Artery
Inf. Vescicular Artery (♂)
(or)
Vaginal Artery (♀)
Uterine Artery
Middle Rectal Artery
Obliterator Artery
Internal Pudendal Artery

Fig: 1

Internal iliac artery

Anterior division	Posterior division
1. Inferior gluteal artery	1. Superior gluteal artery
2. Superior vesicular artery	2. Ilio-lumbar artery
3. Inferior vesicular artery (Males) (or) Vaginal artery (in Females)	3. Lateral sacral artery

4. Uterine artery
5. Middle rectal artery
6. Obturator artery
7. Internal pudendal artery

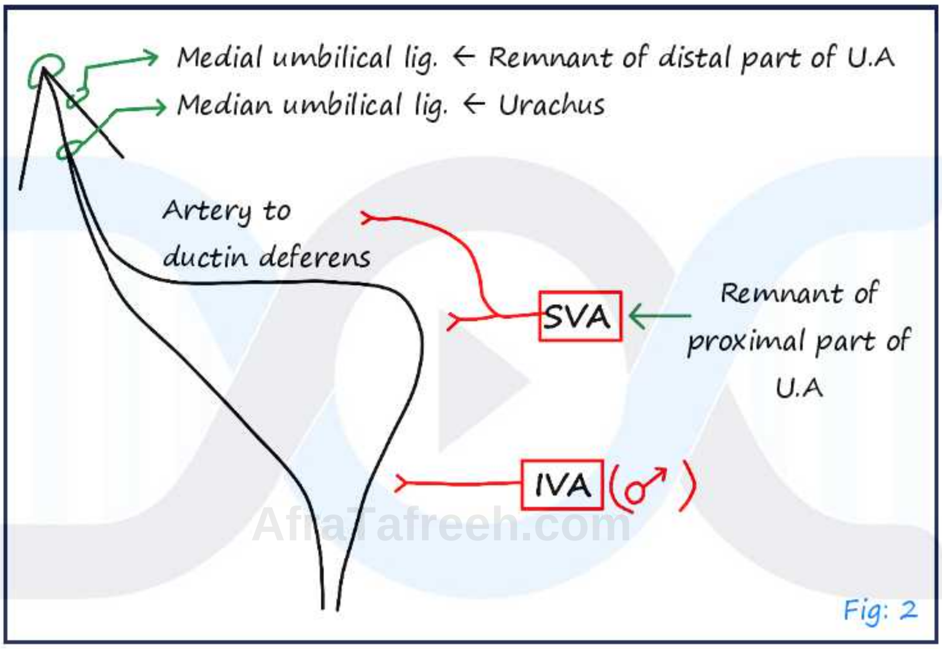

Medial umbilical lig. ← Remnant of distal part of U.A
Median umbilical lig. ← Urachus
Artery to ductin deferens
SVA
Remnant of proximal part of U.A
IVA (♂)

Fig: 2

URINARY BLADDER URETHRA

Urinary bladder 00:00:13

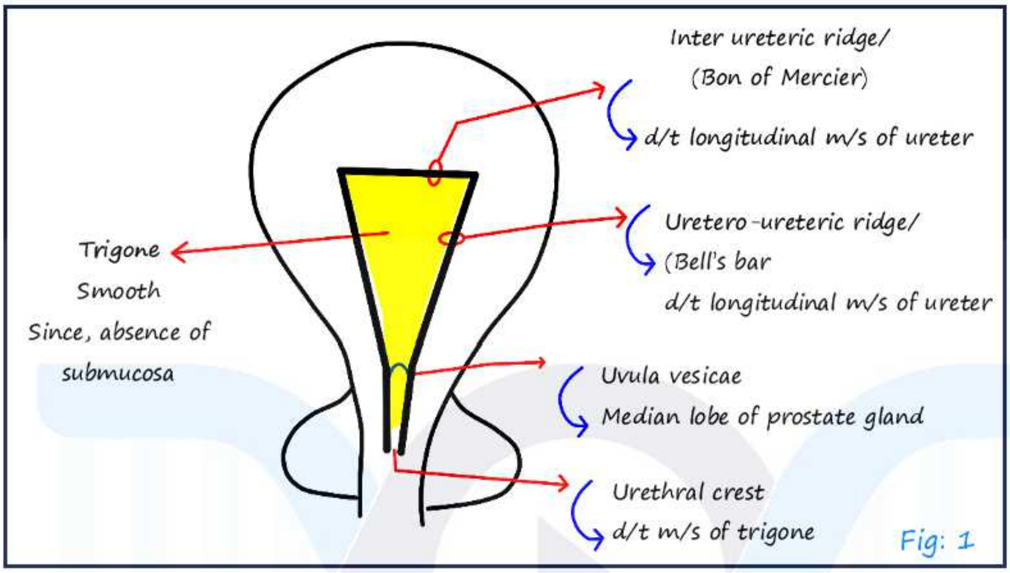

Inter ureteric ridge/
(Bon of Mercier)
d/t longitudinal m/s of ureter
Uretero-ureteric ridge/
(Bell's bar
d/t longitudinal m/s of ureter
Trigone
Smooth
Since, absence of
submucosa
Uvula vesicae
Median lobe of prostate gland
Urethral crest
d/t m/s of trigone

Fig: 1

- Trigone is smooth because of the absence of submucosa
- **Interureteric ridge/ bar of mercier:** formed between the two ureters → formed due to the longitudinal muscles of ureter
- **Uretero – Uretherci ridge/ Bell's bar:** formed between the ureter and the urethra → formed due to the longitudinal muscles of the ureter
- **Uvula vesicae** – formed at the apex of trigone → due to the median lobe of prostate in males
- **Urethral crest:** The muscles of the triangle extend into the prostatic urethra to form the urethral crest

Nerve supply of urinary bladder 00:09:43

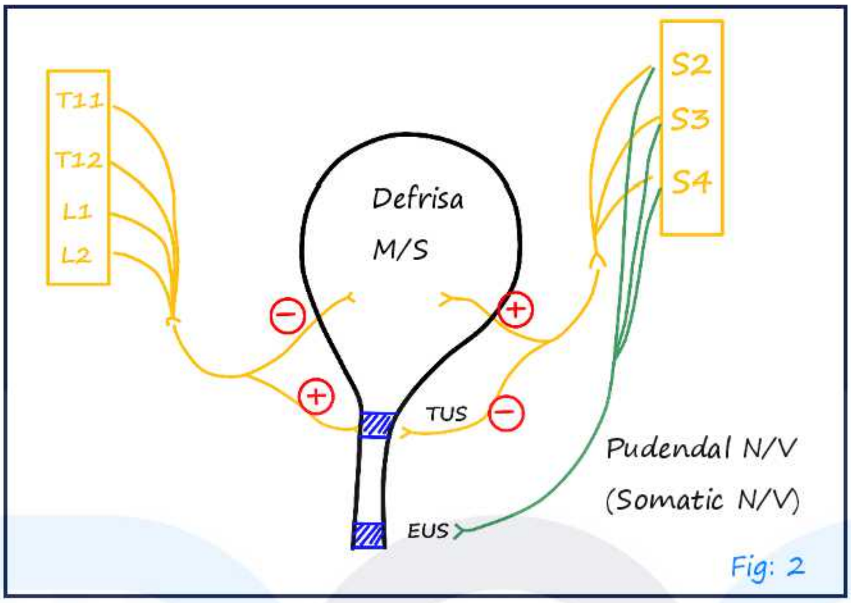

T11
T12
L1
L2
S2
S3
S4
Defrisa
M/S
⊖
⊕
⊕
TUS
⊖
EUS
Pudendal N/V
(Somatic N/V)

Fig: 2

- When parasympathetic nervous system is active:
  - Urination occurs (emptying the UB) → Contraction of detrusor, Relaxation of internal urethral sphicter
- When sympathetic nervous system is active
  - Relaxation of detrusor muscle
  - Closure of IUS

DOI TUTORIALS
LOGIN FOR SUCCESS

Urethra 00:15:01

Male urethra

- 20cms long
- 3 parts

		Cross section
1.Prostatic urethra (3cms)	Most dilatable & widest	Semi-lunar/ horse shoe shaped

2.Membranous urethra (1.5-2cms)	Least dilatable & narrowest	Star shaped
3.Penile urethra (15cms)	Bulbar Spongy Terminal	Trapezoid Horizontal slit Vertical slit

Prostatic urethra 00:20:12

- Trigone continues down to form the urethral crest

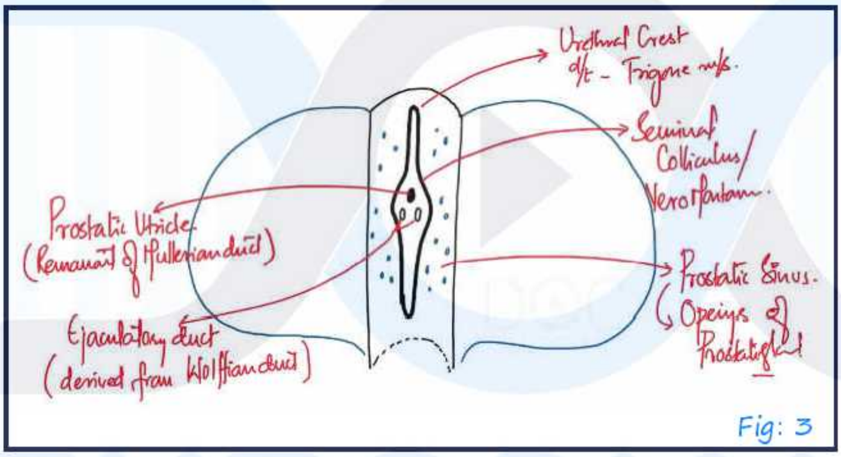

Urethral Crest
d/t - Trigone m/s.
Seminal Colliculus/
Verumontanum.
Prostatic Utricle
(Remnant of Mullerian duct)
Ejaculatory duct
(derived from Wolffian duct)
Prostatic Sinus.
↳ Openings of Prostatic gland

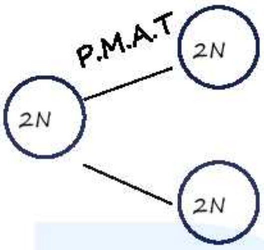
Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS

GAMETOGENESIS AND FIRST WEEK OF DEVELOPMENT

Gametogenesis 00:01:08

MITOSIS



- Parent cell divides into two identical daughter cells.

- 4 stages

  i. Prophase

  ii. Metaphase

  iii. Anaphase

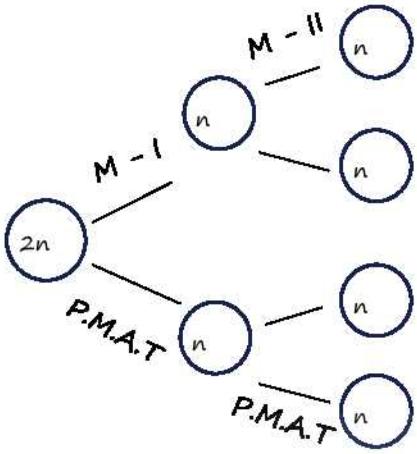
  iv. Telophase

Meiosis

- No. of chromosomes reduce to half in meiosis – I

Stages

Meiosis – I	Meiosis – II
• Prophase – I	• Prophase – II
• Metaphase – I	• Metaphase – II
• Anaphase – I	• Anaphase – II
• Telophase – I	• Telophase – II



Spermatogenesis 00:03:52

- **Location: Seminiferous tubule**
- **Duration: 72-74 days.**

Mitosis → Spermatogonium 1

↓ Mitosis (5-7 cycles)

Meiosis → Primary Spermatocyte (2n)

↓ Meiosis - I

Secondary Spermatocyte (n)

↓ Meiosis - II

Independent assortment of maternal & paternal chromosomes

Morphological changes → Spermatid

↓ Spermiogenesis

Spermatozoa (with head, neck x tail) (63-512)

↓ Spermiation

Release of spermatozoa from Sertoli cells into the lumen of seminiferous tubules.

↓ Migrate to

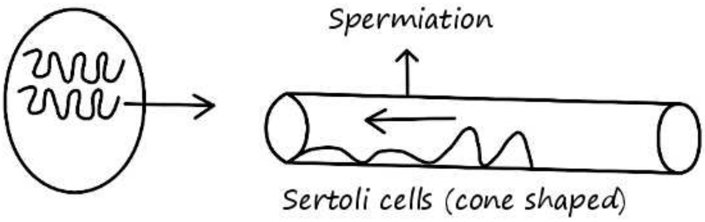
Epididymis ← Storage of spermatozoa

Epididymis ← Maturation of spermatozoa

Epididymis ← Motility

Capacitation: - Final maturation of spermatozoa in fallopian tube (ISTHMUS).

DOC TUTORIALS LOGIN FOR SUCCESS



Oogenesis 00:18:15

Oogonium

↓ Mitosis

Primary Oocyte (2n)

↓ Meiosis – I

Before birth

Birth Arrested in PROPHASE – I (Diplotene stage)

↓

↓

Childhood

↓ Completes meiosis – I

PUBERTY Secondary oocyte (n) + 1st polar body

↓ Meiosis – II

Arrested in Metaphase – II

DOC TUTORIALS
LOGIN FOR SUCCESS

Arrested in Metaphase – II

Spermatozoa +	Spermatozoa -
- It completes meiosis – II if fertilization occurs. - OVUM + 2nd polar body are formed	- Persists as corpus luteum ➔ 14 days Corpus albicans

- Meiosis – II is completed only if fertilization occurs.

First week: Fertilization and Implantation

00:27:54

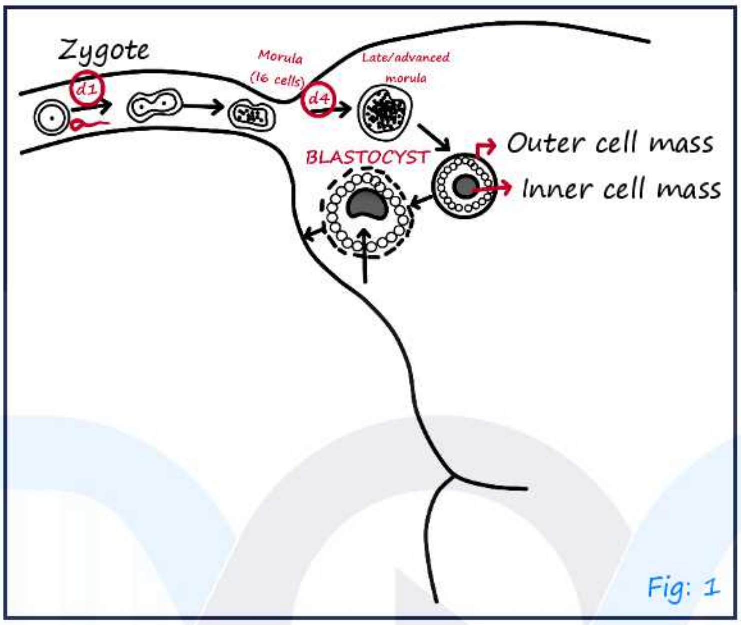

Zygote
d1
Morula
(16 cells)
d4
Late/advanced
morula
BLASTOCYST
Outer cell mass
Inner cell mass

Fig: 1

Zona pellucida:

- Prevents polyspermy
- Prevents ectopic pregnancy

Day 1 → Fertilization

↓

Zygote

↓

Morula (16 cells)

↓

Late/advanced

morula (32 cells)

day 4 → ↓ Enter uterus

BLASTOCYST:

1. Stage of implantation
2. Implantation begins on Day 6
3. Implantation is completed by Day 10

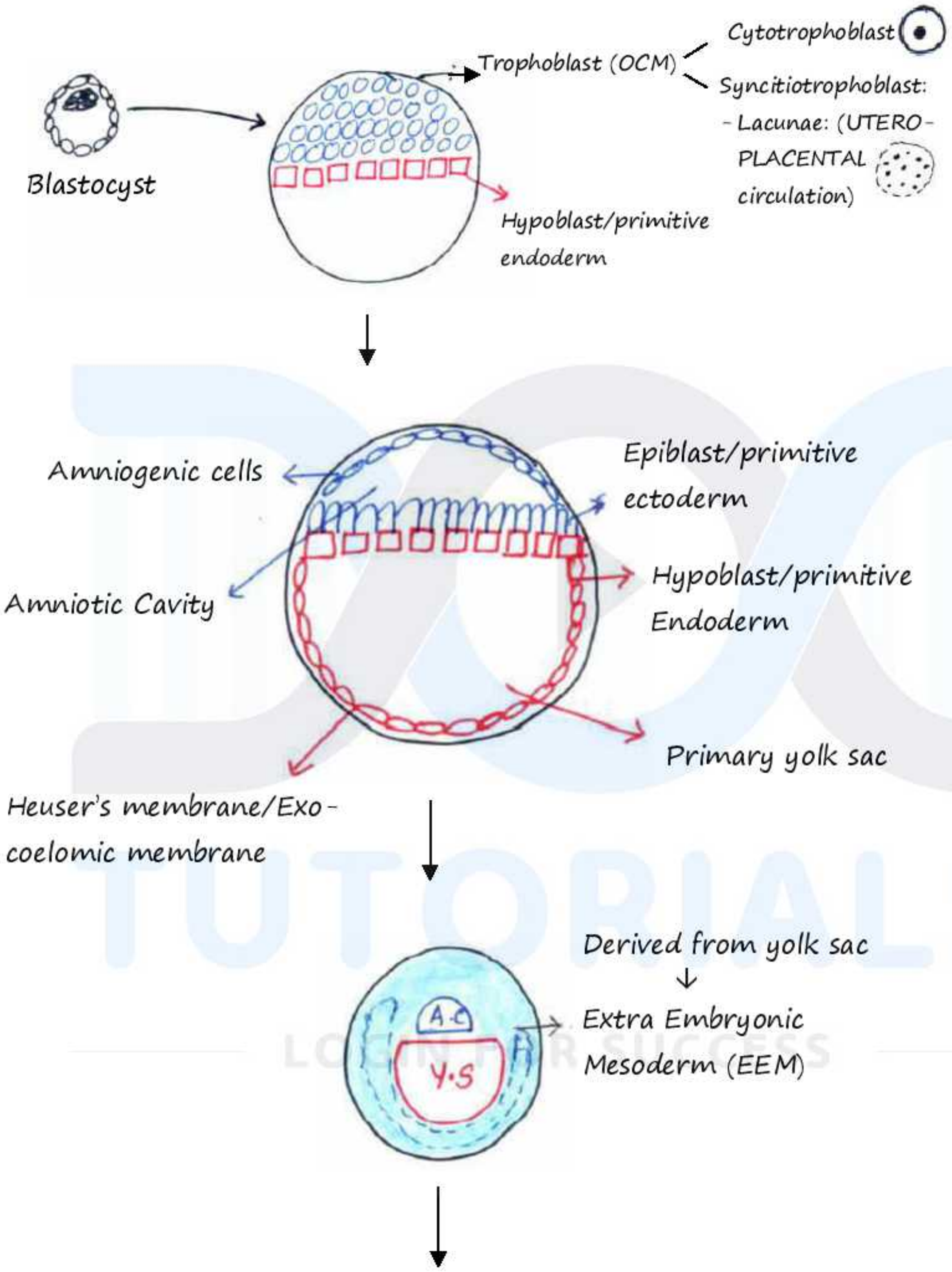
DOC TUTORIALS LOGIN FOR SUCCESS

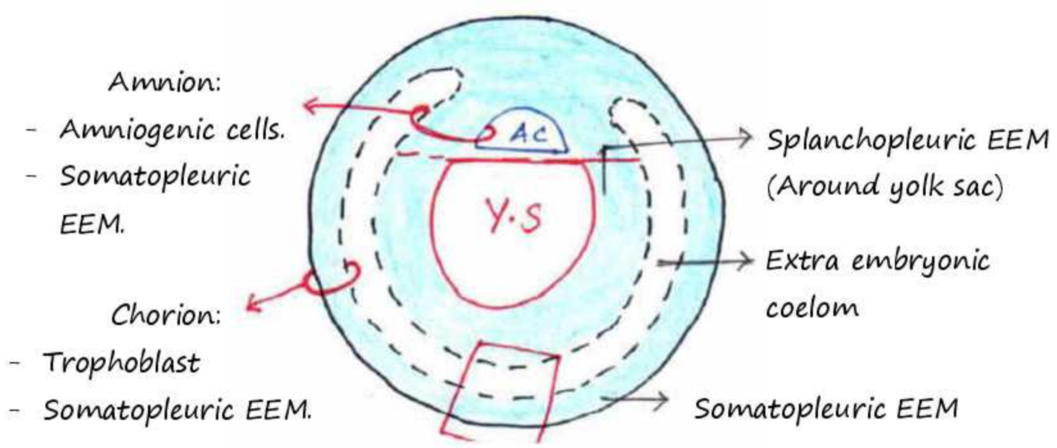
4.Site of implantation:

- Junction of fundus and body of uterus on the posterior wall.

2nd WEEK

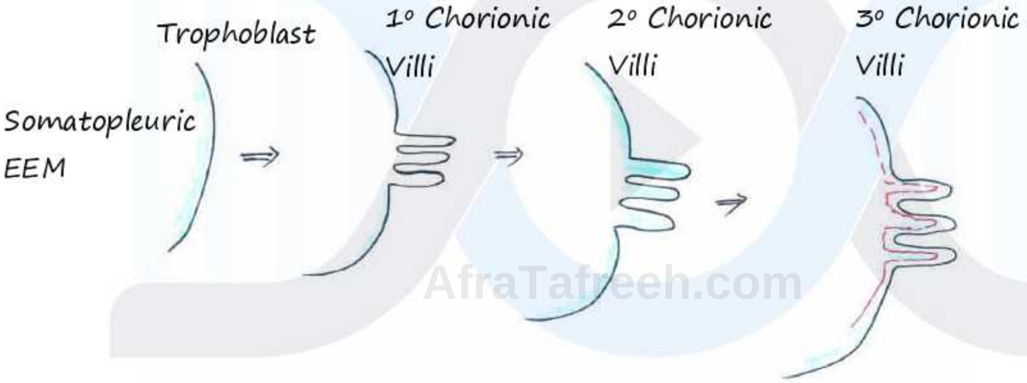
Second Week- Bilaminar Germ Disc 00:00:15


Blastocyst
Trophoblast (OCM)
Cytotrophoblast
Syncitiotrophoblast:
- Lacunae: (UTERO-PLACENTAL circulation)
Hypoblast/primitive endoderm
Amniogenic cells
Epiblast/primitive ectoderm
Amniotic Cavity
Hypoblast/primitive Endoderm
Primary yolk sac
Heuser's membrane/Exo-coelomic membrane
Derived from yolk sac
Extra Embryonic Mesoderm (EEM)
A.C
Y.S


Amnion:
- Amniogenic cells.
- Somatopleuric EEM.
Chorion:
- Trophoblast
- Somatopleuric EEM.
AC
Y.S
Splanchopleuric EEM (Around yolk sac)
Extra embryonic coelom
Somatopleuric EEM

Chorion

00:20:37


Trophoblast
Somatopleuric EEM
⇒
1° Chorionic Villi
⇒
2° Chorionic Villi
→
3° Chorionic Villi

3rd WEEK

3rd Week

- At 3rd week, there is gastrulation i.e., the formation of all the 3 germ layers. (ectoderm, endoderm & mesoderm)
- The cells of epiblast will multiply to form amniogenic cells to form amniotic cavity (AC).
- The cells below forms hypoblast & the hypoblast multiply to form

Heuser's membrane & then there is a yolk sac cavity.

- Outside the embryo, there is an extra – embryonic mesoderm that is surrounded by trophoblast.
- In the extra – embryonic mesoderm, there is an extra – embryonic coelom (EEC).
- EEC – divides the mesoderm int somato pleuric & splanchnopleuric extra-embryonic mesoderm.
- In 3rd week, the development will take place in the epiblast & the hypoblast.

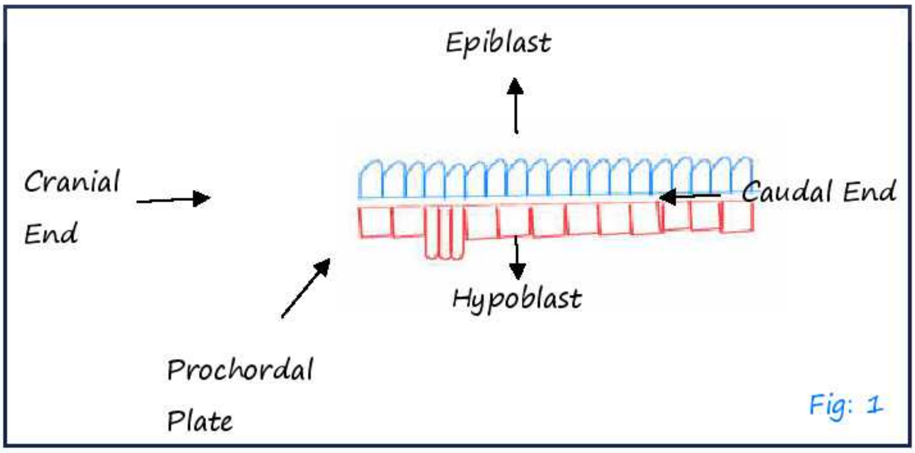


Fig: 1

- Epiblast consists of tall & columnar cells & hypoblast constists of cuboidal / cube shaped cells. But here, some of the cube shaped cells modify into tall and columnar cells & that is referred to as prochordal plate

Function of prochordal plate 00:03:48

- It determines the cranio- caudal axis of embryo.
- On whichever end, the prochordal plate is formed, the head formed on that side.
- The prochordal plate becomes the future buccopharyngeal membrane which later ruptures leading to the formation of oral cavity.

Epiblast Changes 00:05:49

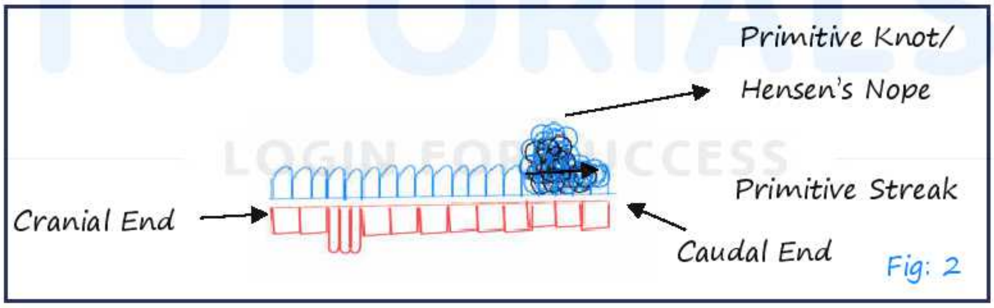


Fig: 2

- In the epiblast some of the cells from the caudal end will multiply & proliferate and move towards the cranial end.
  - They are known as primitive streak cells.

- They multiply to form dense mass of cells as primitive Knot / Hensen's node.

Primitive Streak Cells 00:08:05

- They multiply and form a group of cells & those cells go down is to the hypoblast and they replace all the old cells of hypoblast with the new cells & therefore it becomes definitive endoderm.
- Primitive streak cells will further multiply & form another group of cells & that group of cells move in the middle & in the middle, they form another germ cell layer is mesoderm.
- Again, another group of cells are formed from the primitive streak & they replace their own layer is the epiblast.

  The old cells of epiblast are replaced by new cells & hence it becomes definitive ectoderm.
- Primitive streak forms all 3 germ layers.
- First germ layer to be formed is endoderm.
- Sequence of formation of germ layer.

  Endoderm → Mesoderm → Ectoderm.

Primitive Knot / Hensen's Node

- It is the one which is going to form notochord.
- Notochord is the one which induces the overlying ectoderm to form the neural tube.

TUTORIALS LOGIN FOR SUCCESS

Remnant of Notochord

1. Nucleus pulposus
2. Membrana tectoria
3. Apical ligament of dens

Fate of primitive streak (PS)

- Primitive streak normally disappears from cranial towards caudal end.
- Caudal end of primitive streak persists – known as sacrococcygeal teratoma.

Dorsal Aspect of embryo 00:18:29

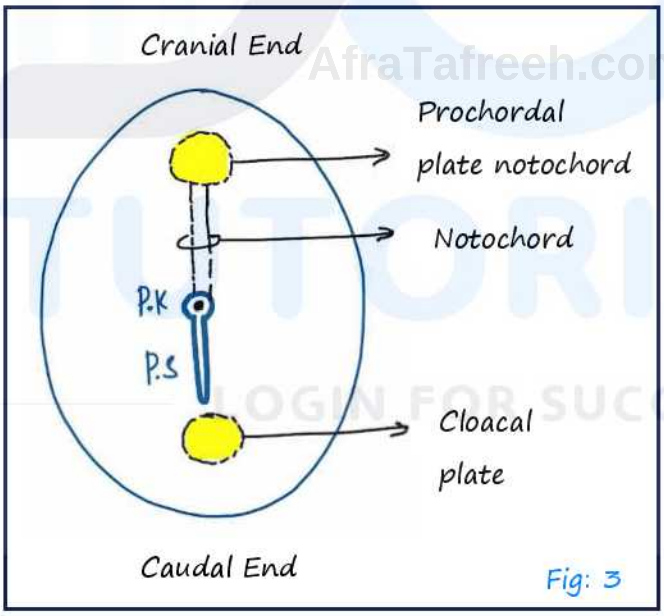

Cranial End
Prochordal plate notochord
Notochord
P.K
P.S
Cloacal plate
Caudal End

Fig: 3

- Primitive streak forms all 3-germ cell layer with mesoderm being in the middle and those cells will multiply and proliferate and move throughout the embryo.

- But the mesoderm is not present in the prochordal plate and Cloacal plate. They consist only ectoderm & endoderm.
- Mesoderm is not present there, so that, it can easily rupture and form an opening.
- The right and left side of the embryo will determined by the notochord present in the middle.

Transverse Section of Embryo 00:23:46

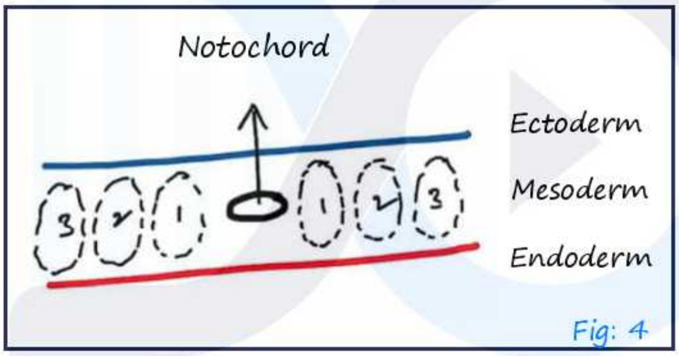


Fig: 4

- There, the intraembryonic mesoderm is divided into 3 parts.

1.Paraxial Mesoderm

- It forms somites.
- Somite period - Day 20 – day 30.
- Initially 42-44 somites are formed
- 36-38 are definitive somites.

- Somites
- It has 3 parts

a. Dermatome → It forms the dermis of back.

b. Sclerotome

- It forms the axial skeleton.
- Mainly the vertebrae & ribs.s

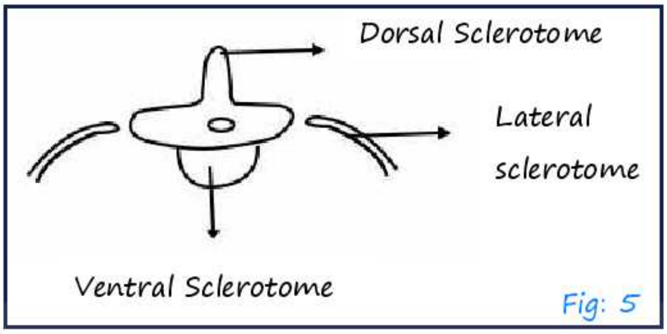

Dorsal Sclerotome
Lateral sclerotome
Ventral Sclerotome

Fig: 5

- If there is a defect in ventral sclerotome, it leads to hemi- vertebrae.
- If there is a defect in dorsal sclerotome, that will be seen in spina bifida.

2.Intermediate Mesoderm

- It helps in the development of urogenital system

3.Lateral plate Mesoderm (LPM)

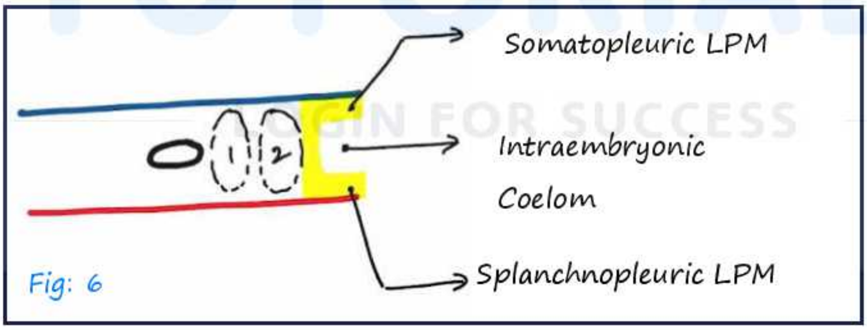

Somatopleuric LPM
1
2
Intraembryonic Coelom
Splanchnopleuric LPM

Fig: 6

- In lateral plate mesoderm, again there is a formation of intraembryonic coelom.
- Because of the coelom, the LPM will be divided into 2 parts i.e., the part along with ectoderm is known as

somatopleuric LPM and the part along with endoderm is known as splanchnopleuric LPM.

- The intraembryonic coelom here form the peri – cardial cavity, pleural cavity and peritoneal cavity.
- Somatopleuric derivatives LPM → It forms parietal layers, dermis of front of the body, appendicular skeleton.
- Splanchopleuric derivative LPM → It forms the visceral layers, smooth muscles and cardiac muscles
- The undifferentiated LPM is known as septum transversum.
- Septum transversum forms:

i. Central tendon of diaphragm
ii. Fibrous pericardium
iii. Stroma of liver & Kupffer cells
iv. Ventral Mesogastrium

- Septum transversum is located towards the cranial end.
- Cranial most structure of the embryo before folding is septum transversum.
- Exceptions in smooth muscle development:

a. Sphincter pupillae & dilator pupillae → Neuro ectoderm
b. Ciliaris muscle → Neural crest cells
c. Smooth muscles of

- Ascending Aorta
- Pulmonary trunk
- Coronary vessels

Neural crest cells

d. Smooth muscles of

- Sweat glands
- Mammary glands

Surface ectoderm

DEVELOPMENT OF HEART

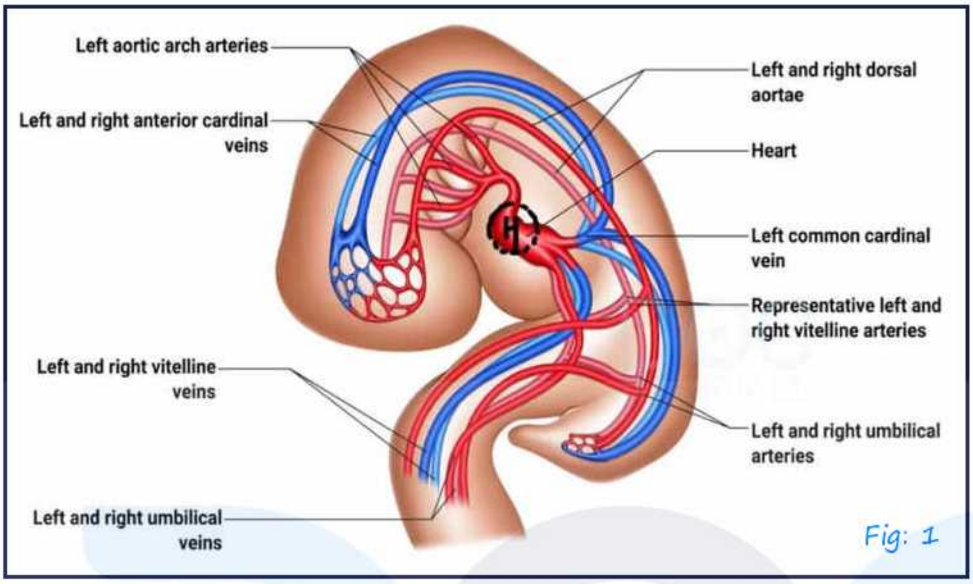
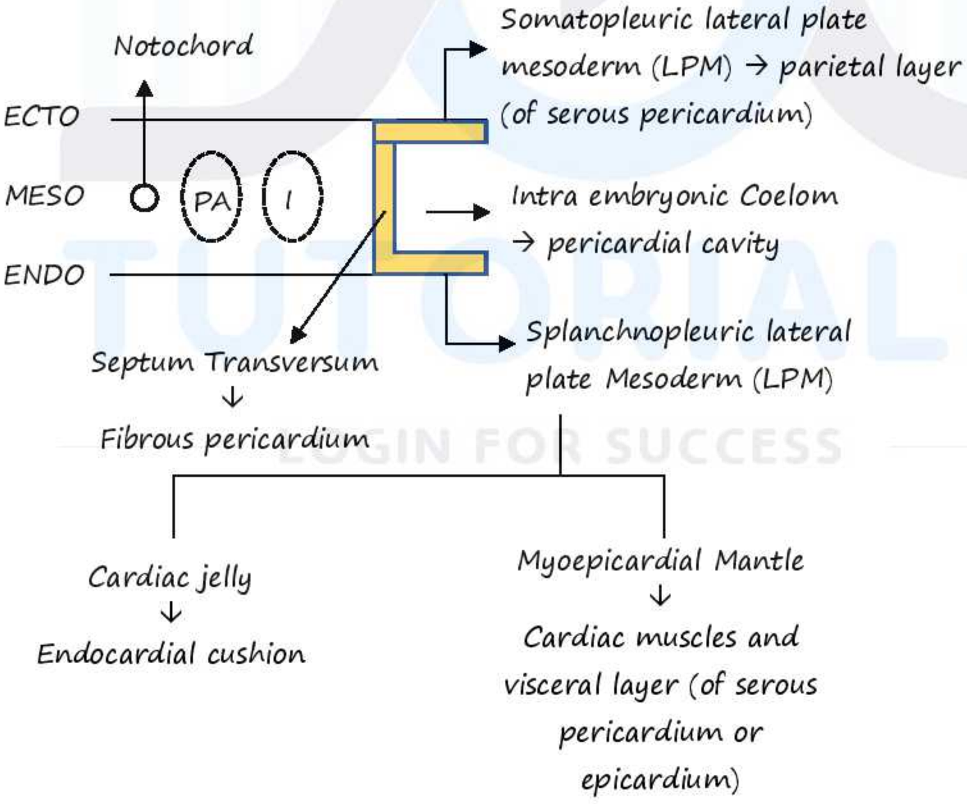

Left aortic arch arteries
Left and right anterior cardinal veins
Left and right vitelline veins
Left and right umbilical veins
Left and right dorsal aortae
Heart
H
Left common cardinal vein
Representative left and right vitelline arteries
Left and right umbilical arteries

Fig: 1

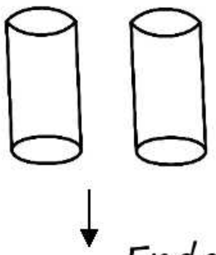
Pericardium 00:01:05


Notochord
ECTO
MESO
ENDO
PA
I
Somatopleuric lateral plate mesoderm (LPM) → parietal layer (of serous pericardium)
Intra embryonic Coelom → pericardial cavity
Splanchnopleuric lateral plate Mesoderm (LPM)
Septum Transversum
↓
Fibrous pericardium
Cardiac jelly
↓
Endocardial cushion
Myoepicardial Mantle
↓
Cardiac muscles and visceral layer (of serous pericardium or epicardium)

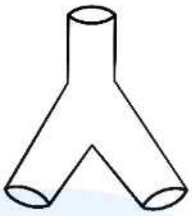
Development of the Heart 00:09:00

- Begins: 16th day.

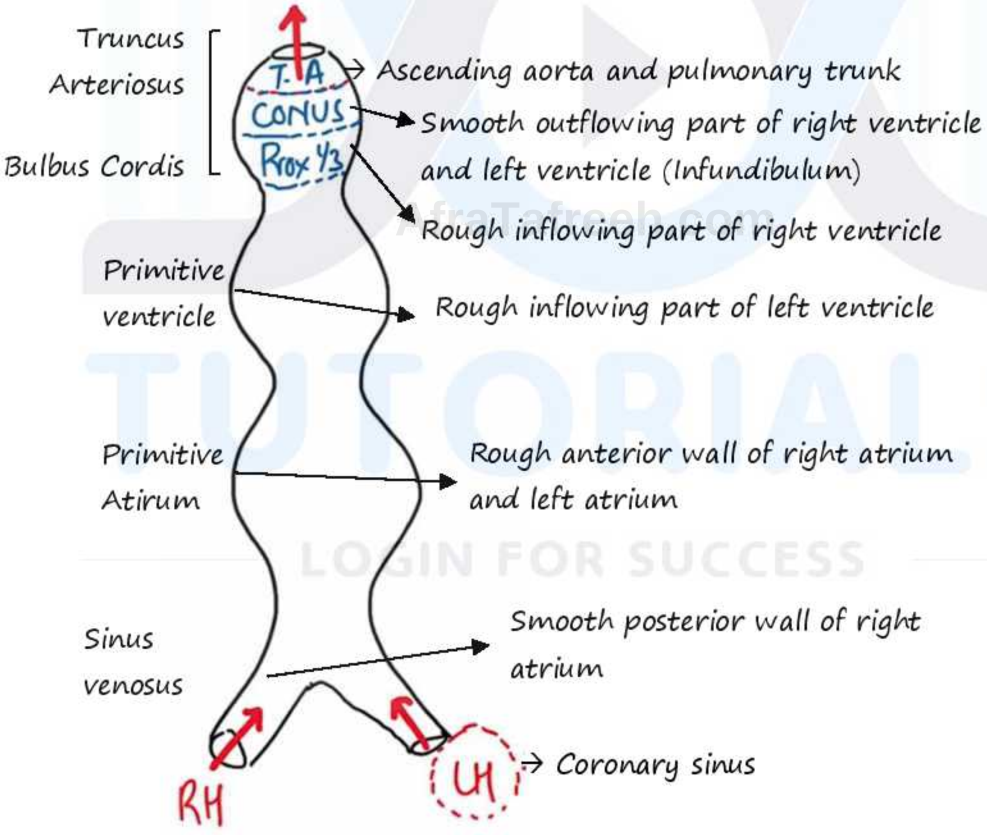
- Heart beat begins: 4th week (22nd day)



Endothelial heart tubes.



Fuses cranially


Truncus
Arteriosus
Bulbus Cordis
T. A
CONUS
Prox 1/3
Ascending aorta and pulmonary trunk
Smooth outflowing part of right ventricle and left ventricle (Infundibulum)
Rough inflowing part of right ventricle
Primitive ventricle
Rough inflowing part of left ventricle
Primitive Atirum
Rough anterior wall of right atrium and left atrium
Sinus venosus
Smooth posterior wall of right atrium
RH
LH
Coronary sinus

DOC TUTORIALS LOGIN FOR SUCCESS AfraTafreeh.com

- Bulbus cordis

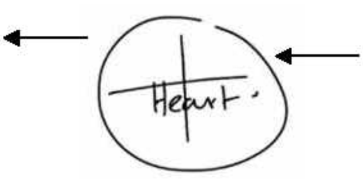
  i. Truncus arteriosus

  ii. Conus

  iii. Proximal 1/3rd

Outflow

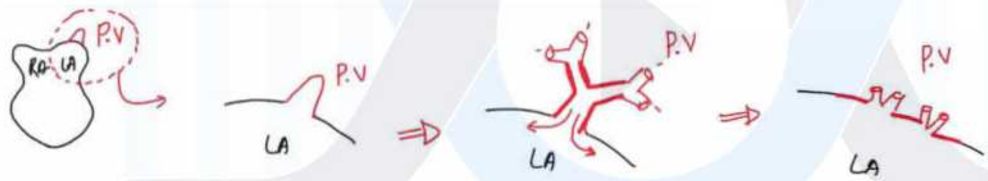
Aorta
pulmonary
Trunk



Inflow

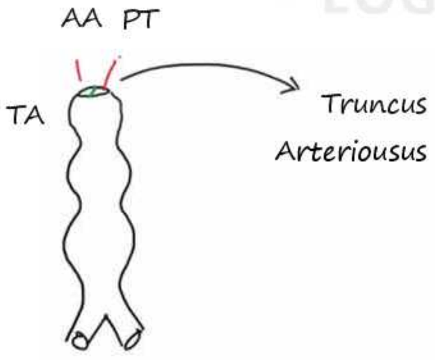
Superior
venacava
Inferior
venacava
Pulmonary
veins
Coronary veins

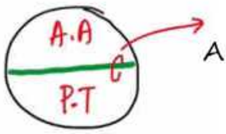
Smooth Posterior Wall of Left Atrium 00:25:36


RA
LA
P.V
P.V
LA
P.V
LA
P.V
LA

- Pulmonary veins are derived from left atrium.
- Smooth posterior wall of left atrium is derived from absorbed part of pulmonary veins.

DX TUTORIALS LOGIN FOR SUCCESS


AA
PT
TA
Truncus
Arteriousus



Derived from
neural crest cells.
↓
Aortico pulmonary
septum/Spiral
septum

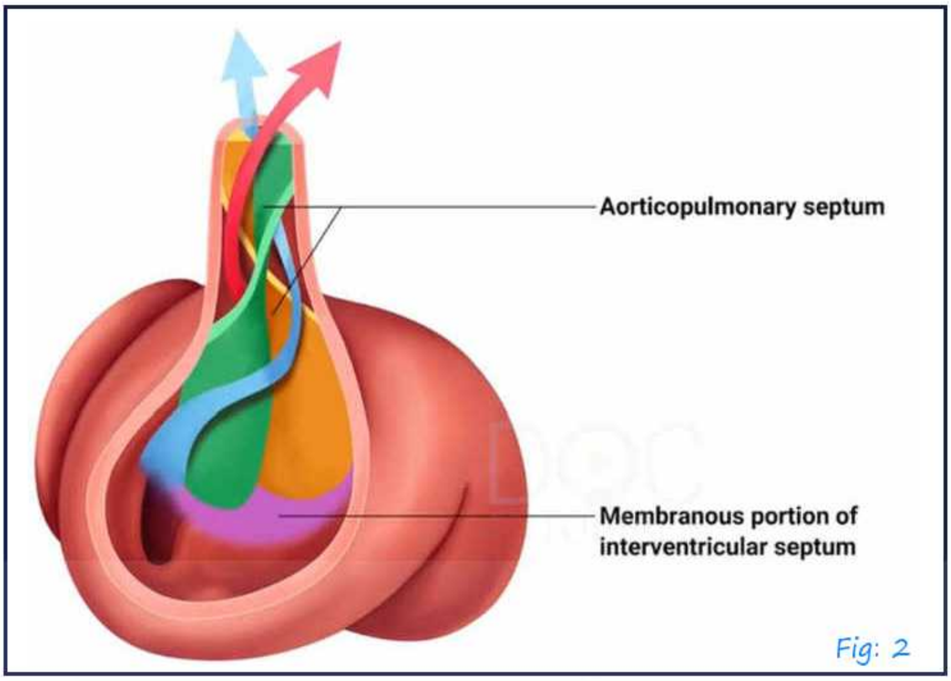

Aorticopulmonary septum
Membranous portion of interventricular septum

Fig: 2

Spiral septum 00:35:25

Spiral septum

- Non-spiral of spiral septum ↓ TGV Transposition of great vessels.
- Absence of spiral septum ↓ PTA Patent Truncus Arteriosus
- Anterior displacement of spiral septum ↓ TOF Tetralogy of Fallot

DOC TUTORIALS LOGIN FOR SUCCESS

DEVELOPMENT OF INTERATRIAL SEPTUM AND INTERVENTRICULAR SEPTUM

Development of Inter atrial Septum 00:10:29

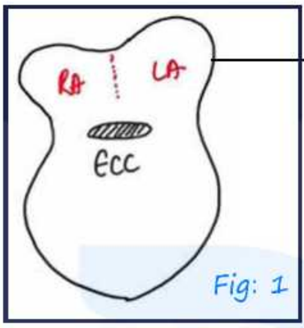


Fig: 1

S.P → Septum primum
F.P → Foramen primum
E.C.C → Endocardial cushion
F.S → Foramen Secundum
S.S → Septum Secundum
F.O → Foramen Ovale

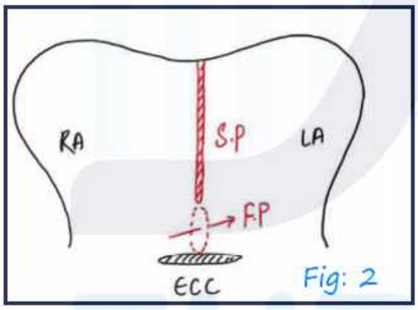
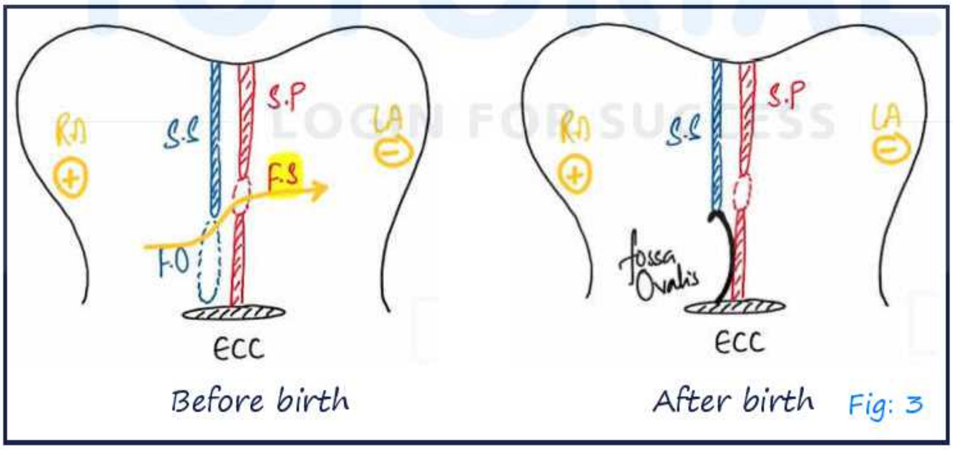

RA
S.P
LA
FP
ECC

Fig: 2


S.S
S.P
RA
+
LA
−
F.S
F.O
ECC
S.S
S.P
RA
+
LA
−
fossa Ovalis
ECC

Before birth

After birth

Fig: 3

DOC TUTORIALS
LOGIN FOR SUCCESS

Foramen ovale → After birth Closes → Fossa ovalis
- Floor → Septum primum
- Marginal /Limbus → Septum Secundum

Development of Intra Ventricular Septum

00:10:29

1.Muscular part ← Cardiac muscle

2.Membranous part ← Endocardial cushion (ECC)

3.Bulbar part ← NCC (Neural Crest Cells)

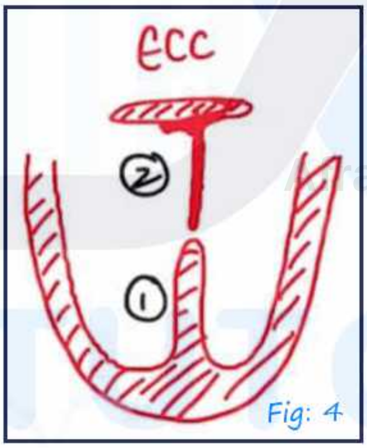


Fig: 4

AiraTafreeh.com
LOGIN FOR SUCCESS

- Aorticopulmonary septum/spiral septum ← NCC

  +

  Bulbar septum ← NCC

  → Cono Truncal Septum
  ↓
  derived from
  Neural Crest Cells
  NCC

- Abnormality in bulbar septum → VSD (Ventricular septal defects)

DEVELOPMENT OF ARTERIAL SYSTEM

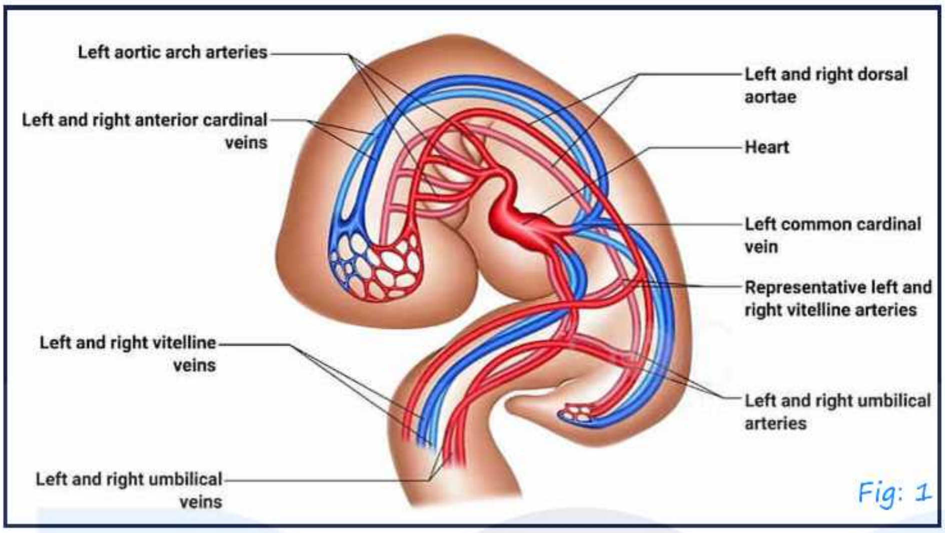

Left aortic arch arteries
Left and right anterior cardinal veins
Left and right vitelline veins
Left and right umbilical veins
Left and right dorsal aortae
Heart
Left common cardinal vein
Representative left and right vitelline arteries
Left and right umbilical arteries

Fig: 1

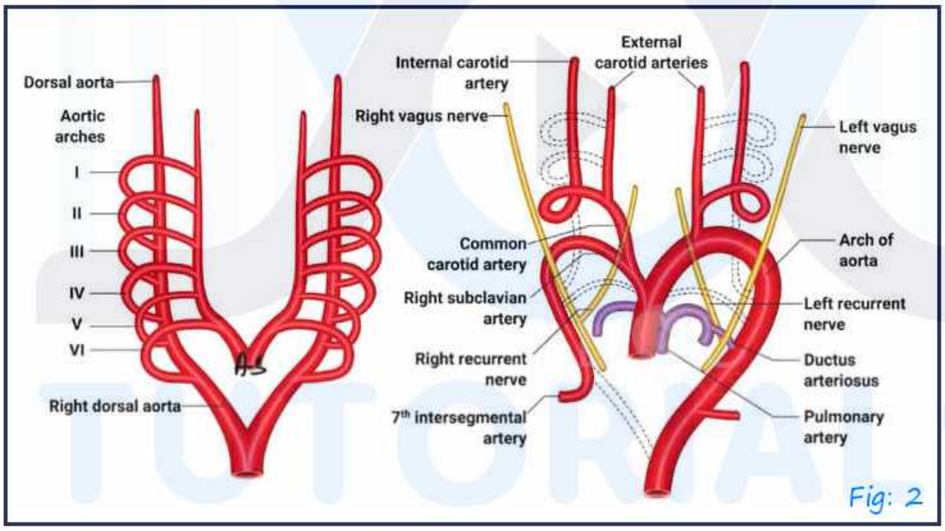

Dorsal aorta
Aortic arches
I
II
III
IV
V
VI
Right dorsal aorta
Internal carotid artery
External carotid arteries
Right vagus nerve
Left vagus nerve
Common carotid artery
Arch of aorta
Right subclavian artery
Left recurrent nerve
Right recurrent nerve
Ductus arteriosus
7th intersegmental artery
Pulmonary artery

Fig: 2

Arch of Aorta 00:03:48

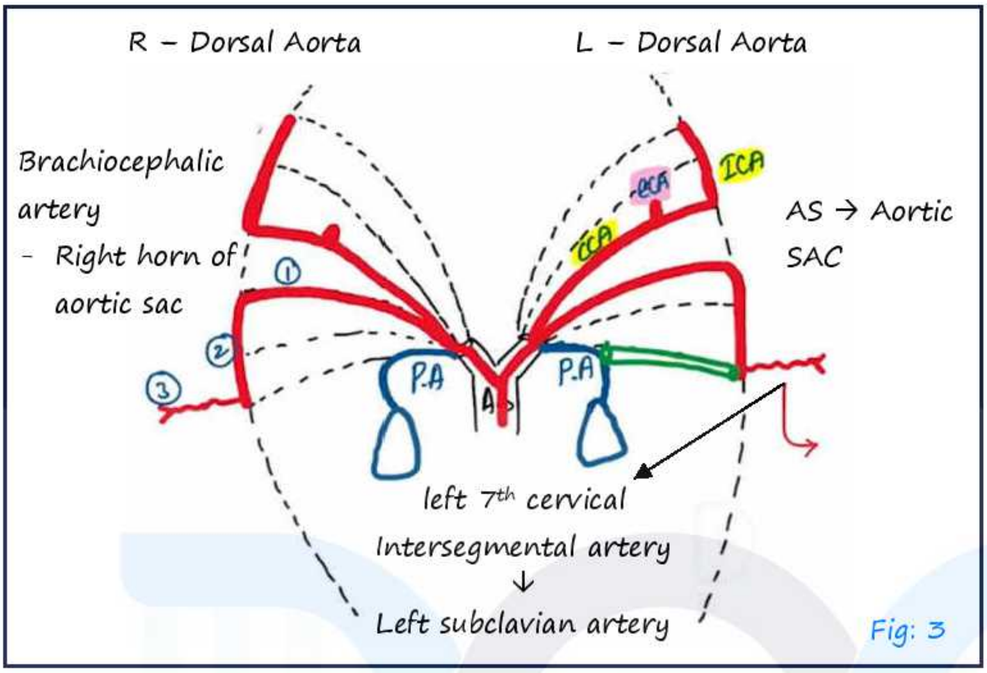

R – Dorsal Aorta
L – Dorsal Aorta
Brachiocephalic artery
- Right horn of aortic sac
①
②
③
P.A
P.A
A
ICA
ECA
CCA
AS → Aortic SAC
left 7th cervical Intersegmental artery
↓
Left subclavian artery

Fig: 3

Arch of Aorta

i. Aortic sac

ii. Left horn of Aortic Sac

iii. Left 4th arch artery

iv. Left dorsal aorta

AfroTafreeh.com
DOC TUTORIALS
LOGIN FOR SUCCESS

- Common carotid artery
  - Proximal part of 3rd arch artery.
- Internal carotid artery
  - Distal part of 3rd arch artery and dorsal aorta.
- Right subclavian artery
  - i. Right 4th arch artery
  - ii. Right dorsal aorta
  - iii. Right 7th cervical intersegmental artery

- Pulmonary artery
  - Proximal parts of 6th arch arteries
- Ductus arteriosus
  - Distal parts of 6th arch arteries

Pharyngeal 00:20:25

Arch	Artery
1	Maxillary Artery
2	Stapedial artery and hyoid artery
3	Common carotid artery and internal carotid artery
4	Arch of aorta and subclavian artery
5	Degenerates
6	Pulmonary artery and Ductus arteriosus

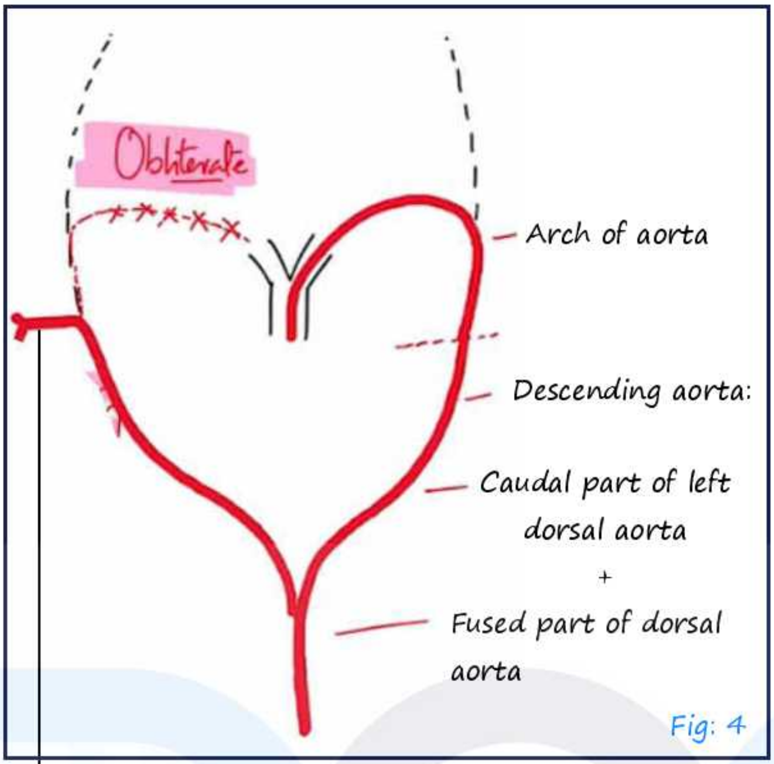

Obliterate
Arch of aorta
Descending aorta:
Caudal part of left dorsal aorta
+
Fused part of dorsal aorta

Fig: 4

Abnormal right subclavian artery:

Cause – Right 4th arch artery obliterates

Caudal part of right dorsal aorta

+

Right 7th cervical intersegmental artery

Double Arch of Aorta

- Persistence of both 4th arch arteries

  +

  Persistence of both caudal dorsal aorta

AfraTafreen.com
DOC TUTORIALS
LOGIN FOR SUCCESS

CVS EMBRYOLOGY-DEVELOPMENT OF VENOUS SYSTEM

Development of venous System

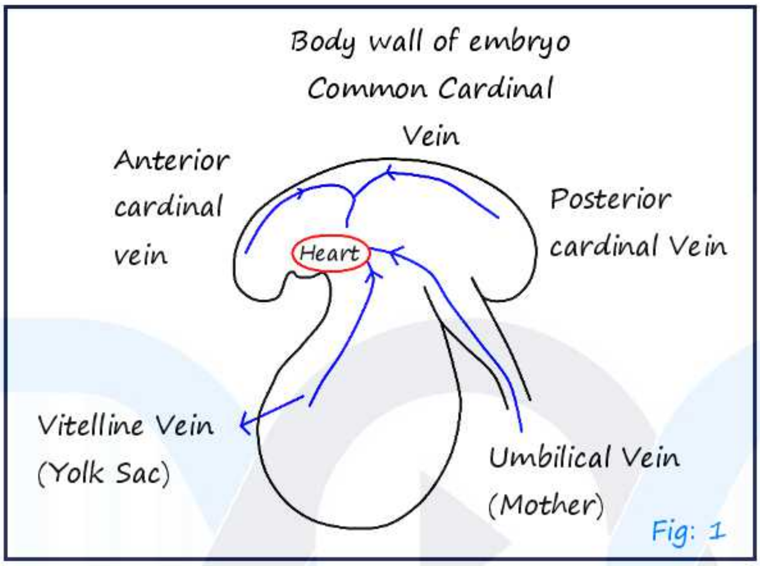

Body wall of embryo
Common Cardinal Vein
Anterior cardinal vein
Posterior cardinal Vein
Heart
Vitelline Vein (Yolk Sac)
Umbilical Vein (Mother)

Fig: 1

Three sets of veins during development

i. Umbilical Vein

ii. Vitelline Vein

iii. Cardinal Vein

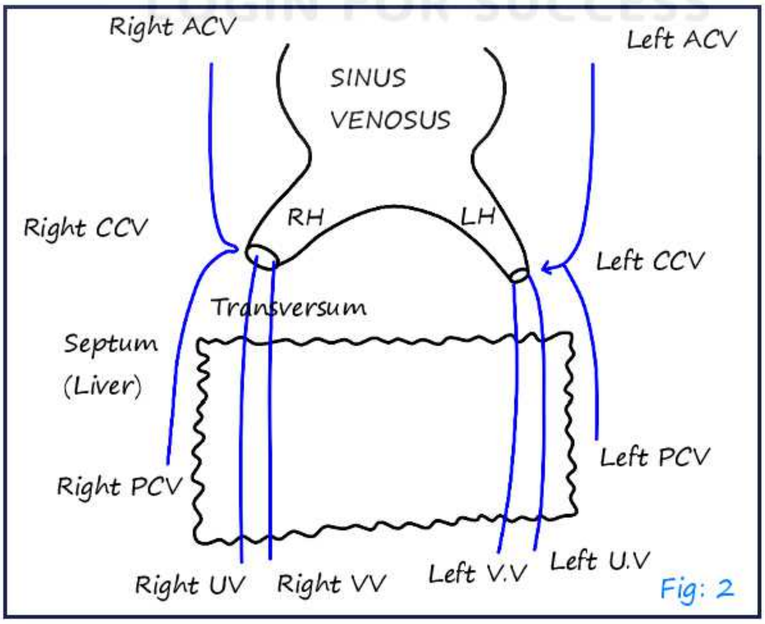
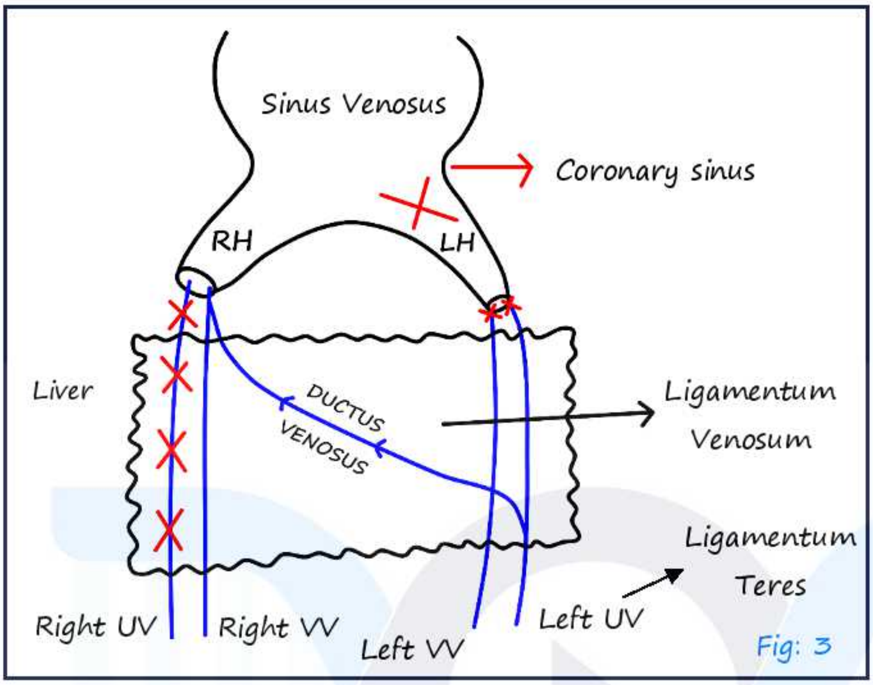

Right ACV
Left ACV
SINUS VENOSUS
RH
LH
Right CCV
Left CCV
Transversum
Septum (Liver)
Right PCV
Left PCV
Right UV
Right VV
Left V.V
Left U.V

Fig: 2

Fate of Umbilical Veins 00:10:42


Sinus Venosus
Coronary sinus
RH
LH
Liver
DUCTUS
VENOSUS
Ligamentum
Venosum
Ligamentum
Teres
Right UV
Right VV
Left VV
Left UV
Fig: 3

- Right umbilical vein (Right UV) → Will regress
- The left horn of sinus venosus is gone; the remnant of which is the CORONARY SINUS
- The cranial parts of left umbilical vein and left vitelline vein (VV) are also gone

AiraTafreeh.com
TUTORIALS
LOGIN FOR SUCCESS

Right Umbilical vein regresses

↓

Left horn (LH) of Sinus venosus degenerates

[Remnant → CORONARY SINUS]

↓

Cranial parts of left UV and Left V.V degenerate

↓

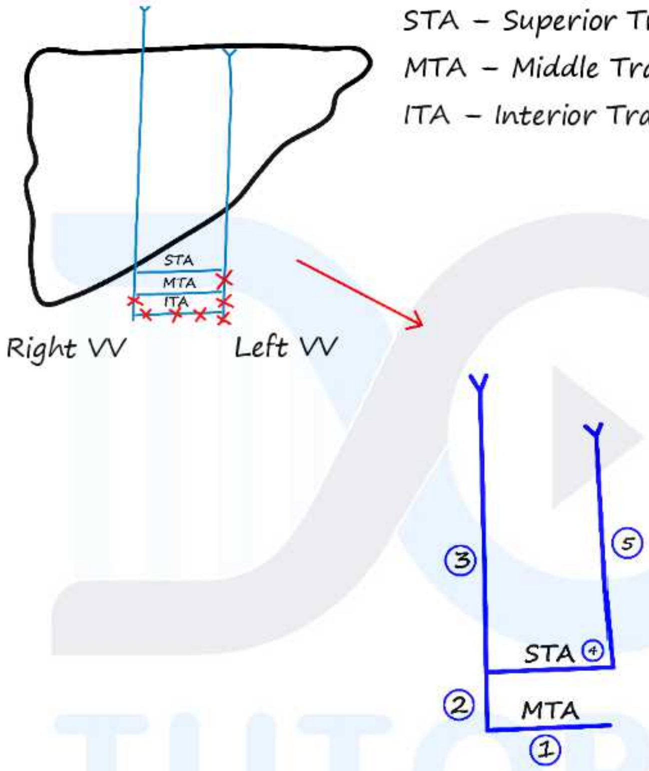
Only connection left is Right hepato

Cardiac channel [right HCC]

↓

Therefore, Ductus Venosus is formed between left umbilical vein and right Hepato Cardiac Channel

Fate of Vitelline Veins: 00:23:29



STA – Superior Transverse Anastomosis
MTA – Middle Transverse anastomosis
ITA – Interior Transverse anastomosis

- Portal vein is derived from = Middle Transverse anastomosis + Right Vein

DOC TUTORIALS
LOGIN FOR SUCCESS

- Right branch of portal vein → Formed by three right vitelline vein
- Left branch of portal vein → Formed by 4 + 5
  Superior Transverse anastomosis + Left vitelline vein

Derivatives of Vitelline Vein 00:30:12

i. Splenic vein

ii. Superior Mesenteric Vein

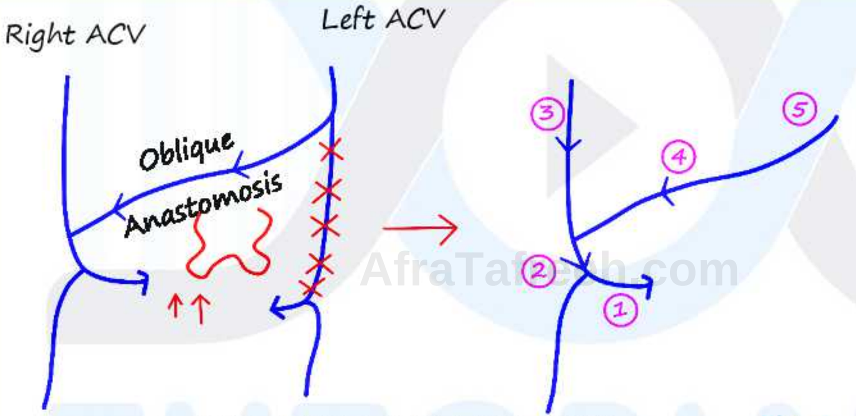
iii. Portal Vein

iv. Sinusoids of liver

v. Central Vein

vi. Hepatic Veins

Fate of Cardinal Veins 00:32:09



SVC → Right CCV + Right ACV

Fig: 4

AfraTafseeh.com
TUTORIALS
LOGIN FOR SUCCESS

- Right Brachiocephalic vein → Right ACV
- Left Brachiocephalic vein → Oblique anastomosis + Left anterior cardinal vein

Double Superior Ven cava

- Persistence of left anterior cardinal vein (left ACV)
- Therefore, absence of oblique Anastomosis
- Left ACV → drains the blood into CORONARY SINUS

Formation of Inferior Venacava 00:40:50

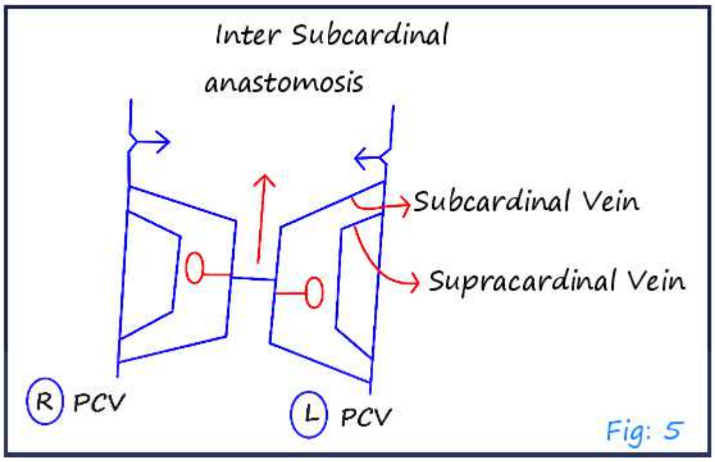

Inter Subcardinal anastomosis
Subcardinal Vein
Supracardinal Vein
R PCV
L PCV

Fig: 5

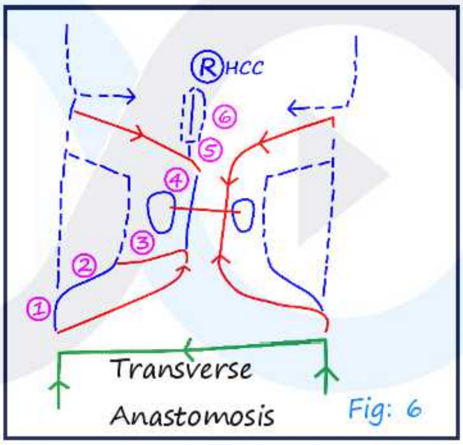

R HCC
⑥
⑤
④
③
②
①
Transverse Anastomosis

Fig: 6

TUTORIALS LOGIN FOR SUCCESS

Suprarenal Veins

- Derived from cranial part of Sub cardinal vein

Gonadal Veins

- Derived from caudal part of sub cardinal vein

INFERIOR VENACAVA

i. Right posterior cardinal vein

ii. Right supra cardinal vein

iii. Anastomosis (between Supra and Sub Cardinal)

iv. Right Sub cardinal Vein

v. Anastomosis

vi. Right Hepato cardiac channel

Right Renal Vein

- Derived from right Mesonephric Vein

Left Renal Vein

i. Left Mesonephric Vein

ii. Left Sub cardinal Vein

iii. Inter sub cardinal Anastomosis

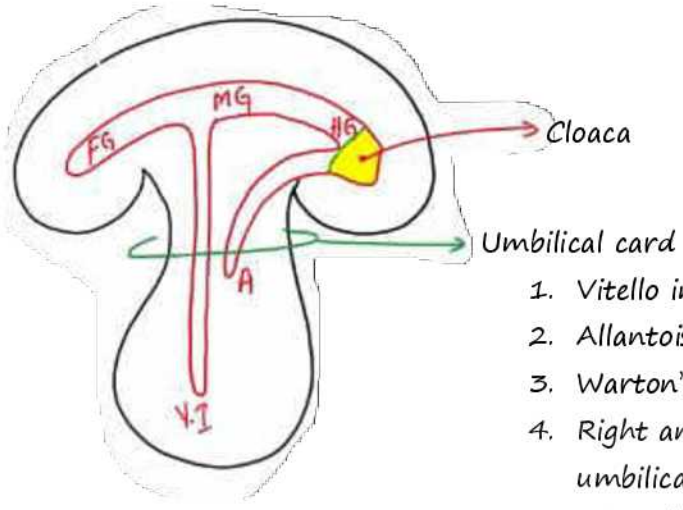
- Left supra renal vein and left gonadal vein drain blood into left Renal vein
- Right supra renal vein and right gonadal vein drain the blood into inferior Vena cava

Double Inferior Vena cava 00:53:28

- Persistence of:
  - Left Posterior cardinal vein
  - Left supra cardinal vein
  - Anastomosis
  - Left Sub Cardinal vein

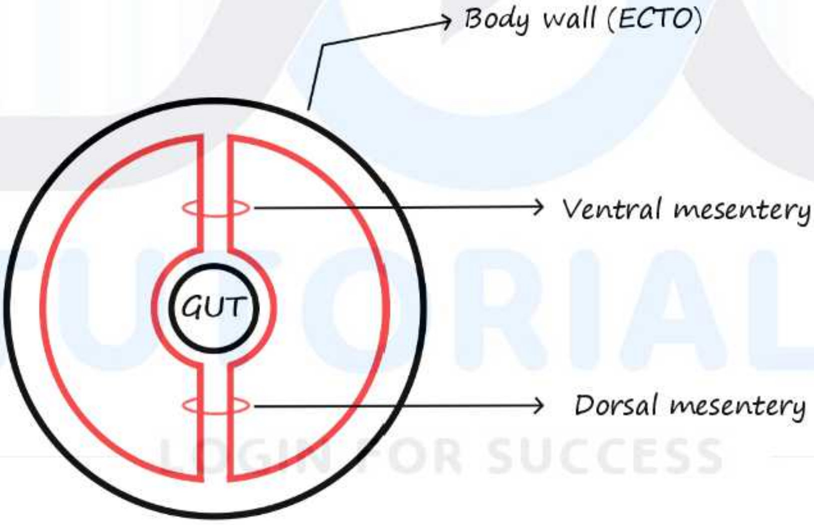
SACRO-CARDINAL VEIN

GUT EMBRYOLOGY PART - I


MG
FG
HG
A
Y.I
Cloaca
Umbilical card

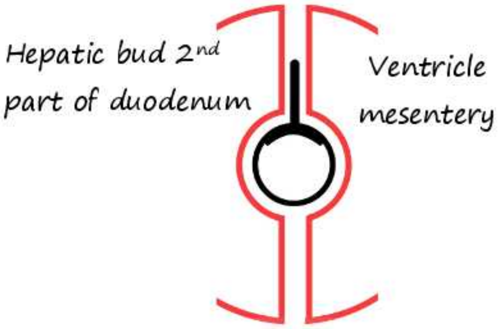
1. Vitello intestinal duct
2. Allantois
3. Warton's jelly
4. Right and left umbilical arteries
5. (L) umbilical vein

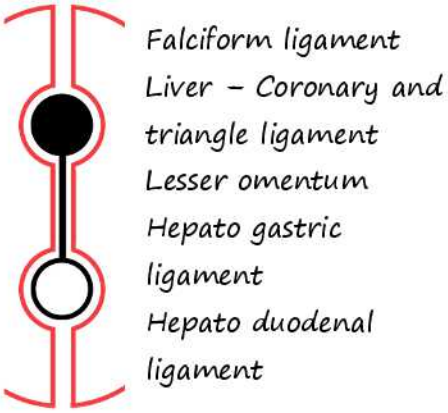
Foregut 00:06:05


Body wall (ECTO)
Ventral mesentery
GUT
Dorsal mesentery

DOC TUTORIALS
LOGIN FOR SUCCESS

Development of liver 00:10:44


Hepatic bud 2nd part of duodenum
Ventricle mesentery

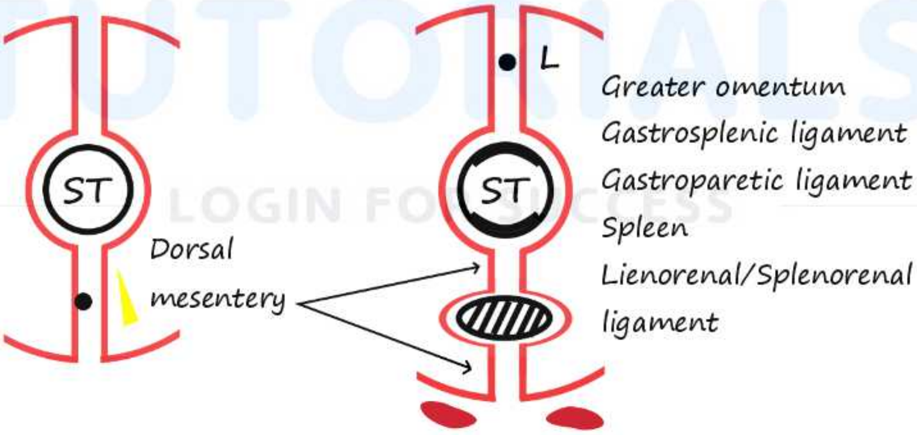

Falciform ligament
Liver – Coronary and triangle ligament
Lesser omentum
Hepato gastric ligament
Hepato duodenal ligament

Liver

- Develops from hepatic bud (Endoderm) Biliary apparatus and hepatocytes.
- Septum transversum (Mesoderm) → Stroma of liver and kupffer cells

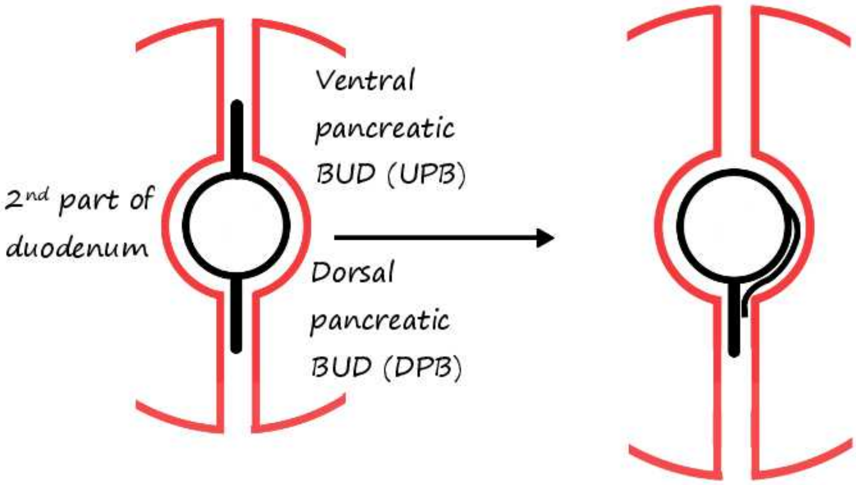
Spleen 00:21:36

DOCTUTORIALS LOGIN FOR SUCCESS


L
ST
ST
Dorsal mesentery
Greater omentum
Gastrosplenic ligament
Gastroparetic ligament
Spleen
Lienorenal/Splenorenal ligament

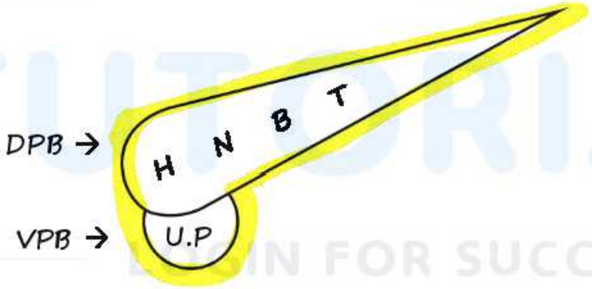
- Spleen develops in dorsal mesogastrium
- Spleen in mesodermal in origin.

Pancreas 00:28:28


Ventral
pancreatic
BUD (UPB)
2nd part of
duodenum
Dorsal
pancreatic
BUD (DPB)

Dorsal pancreatic BUD (DPB)

- Head (Upper part)
- Neck
- Body
- Tail

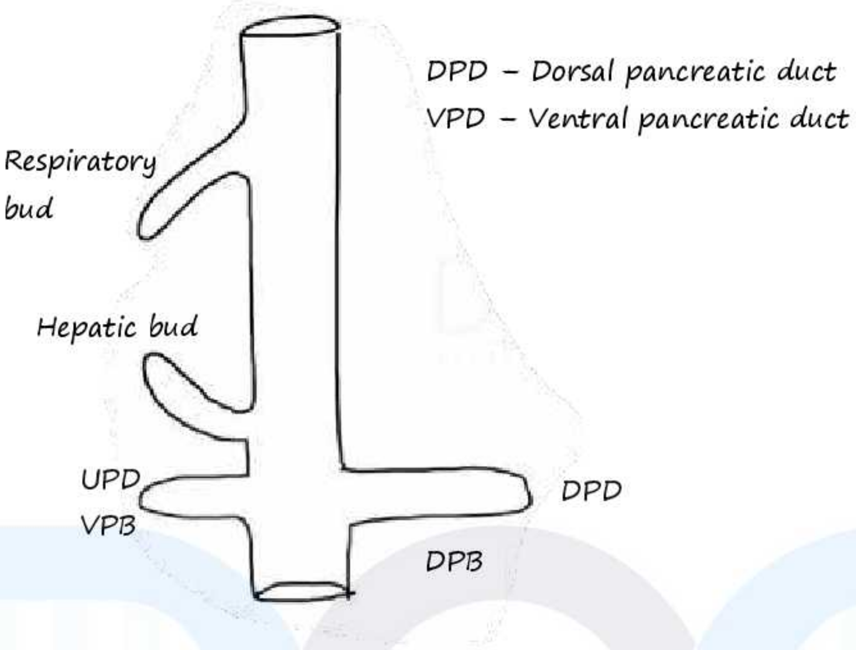

DPB →
VPB →
H
N
B
T
U.P

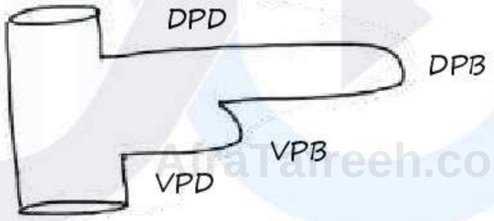
Ventral pancreatic bud (UPB)

- Head (Lower part)
- Uncinate process

DOC TUTORIALS LOGIN FOR SUCCESS

Foregut


DPD – Dorsal pancreatic duct
VPD – Ventral pancreatic duct
Respiratory bud
Hepatic bud
UPD
VPB
DPD
DPB


DPD
DPB
VPB
VPD

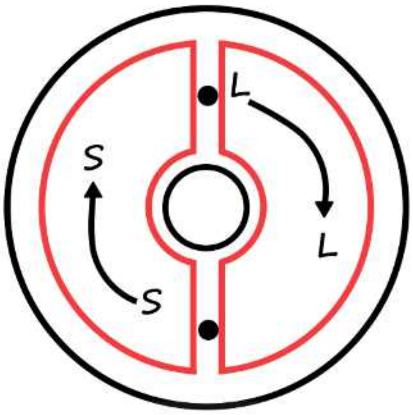
DOC TUTORIALS
LOGIN FOR SUCCESS

- Main pancreatic duct/Wessing's duct: Ventail pancreatic duct + Distal part of dorsal pancreatic duct
- Accessory pancreatic duct/Duct of Santorini/Santorini's duct: Proximal part of dorsal pancreatic duct

Rotation of Gut 00:41:11

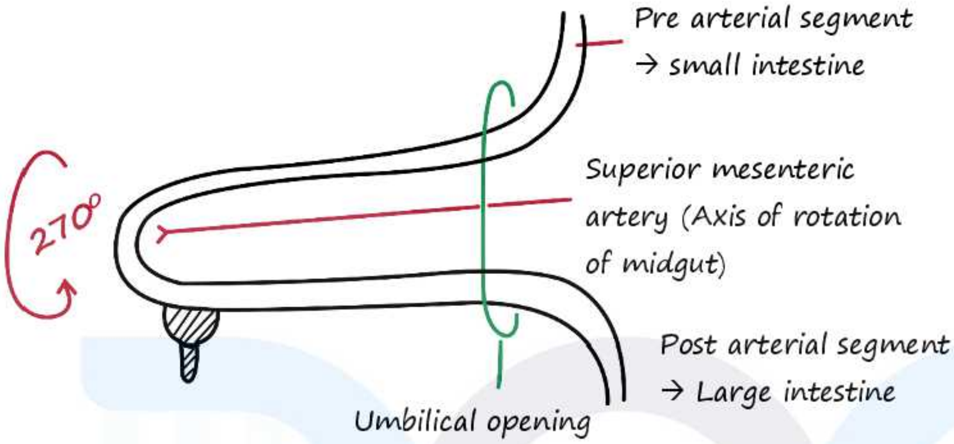
- Foregut – 90° (Clock wise)
- Midgut – 270° (Anti-clockwise)
- Hind gut – x (Does not rotate)

Foregut



GUT EMBRYOLOGY PART – II MIDGUT

Midgut 00:00:21


Pre arterial segment
→ small intestine
Superior mesenteric
artery (Axis of rotation
of midgut)
Post arterial segment
→ Large intestine
Umbilical opening
270°

- Physiological hernia → 6th week
- Reduction of physiological hernia → 10th week
- Failure of reduction of physiological hernia

↓

OMPHACELE

AfraTafreen.com
DX TUTORIALS
LOGIN FOR SUCCESS

Rotation of Midgut 00:10:38

1st Rotation – 90° Anti-clockwise

- Result: Pre arterial segment towards right

Post arterial segment towards left

2nd Rotation – 90° Anit-clockwise

- Result: Pre arterial segment is overlapped by post arterial segment.

Midline caecum

3rd Rotation – 90° Anti-clockwise

- Result: Midline caecum

↓

Sub hepatic/subpyloric calcium

↓ differential growth of abdominal wall

Right Iliac fossa

Anomalies 00:16:57

Non - Rotation

- 1st rotation is normal

  2nd and 3rd rotations do not occur
- Result: Small intestine towards right

  Large Intestine towards left.

Reverse Rotation

- 1st rotation is normal

  2nd and 3rd rotations occur in clockwise direction
- Result: Small intestine and superior mesenteric artery overlaps the transverse colon.

Malrotation

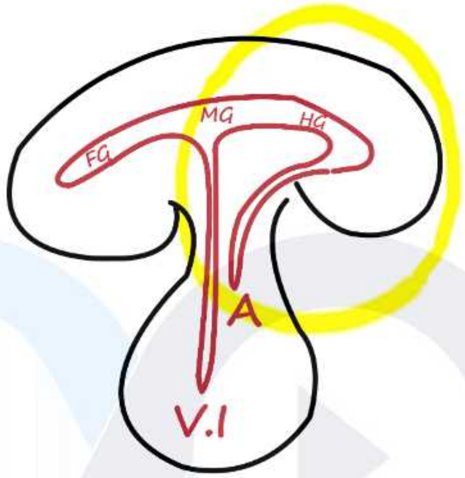
- 1st and 2nd rotations are normal.

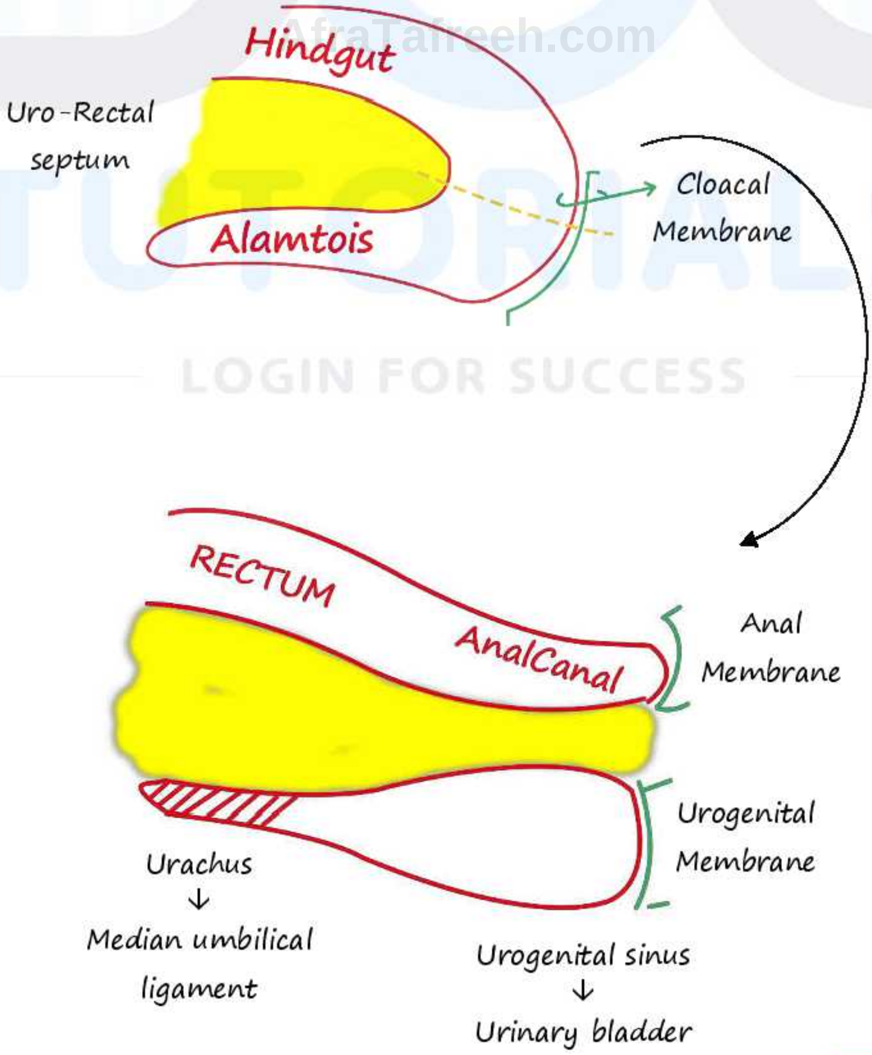
  3rd rotation does not occur.
- Result: Midline Caecum (with Lad-band)

TUTORIALS LOGIN FOR SUCCESS

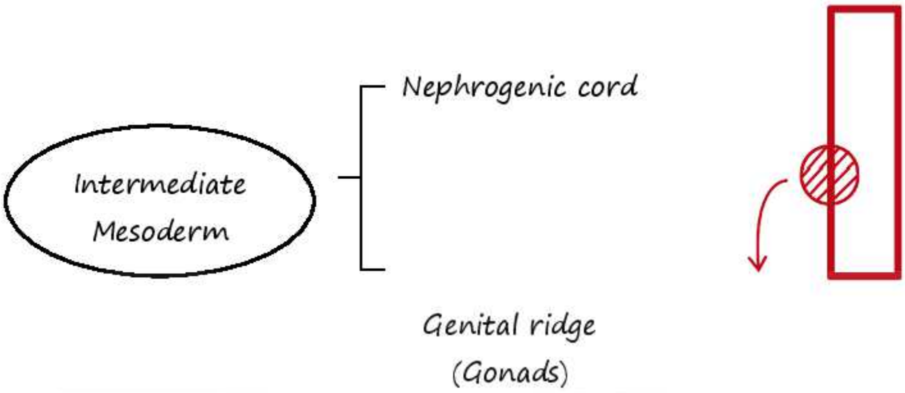
GUT EMBRYOLOGY PART - III HINDGUT AND UROGENITAL SYSTEM

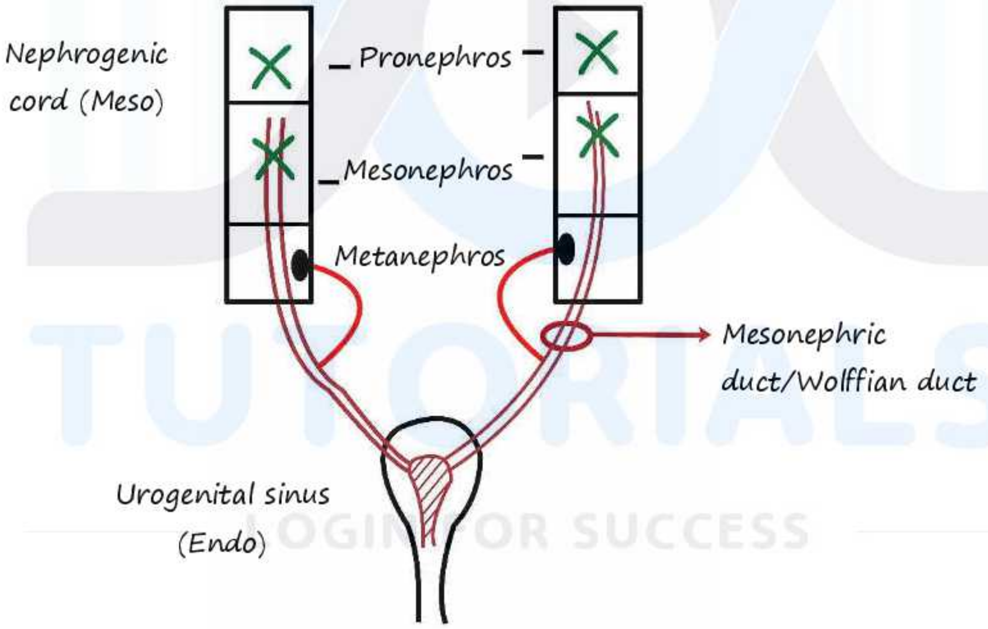
Hindgut and Urogenital System 00:00:25




Hindgut
Uro-Rectal septum
Alamtois
Cloacal Membrane
RECTUM
AnalCanal
Anal Membrane
Urogenital Membrane
Urachus
↓
Median umbilical ligament
Urogenital sinus
↓
Urinary bladder

- Weeping urinary bladder → Dribbling of urine from the umbilicus due to non-closure of urachus.


Intermediate Mesoderm
Nephrogenic cord
Genital ridge
(Gonads)


Nephrogenic cord (Meso)
Pronephros
Mesonephros
Metanephros
Mesonephric duct/Wolffian duct
Urogenital sinus (Endo)

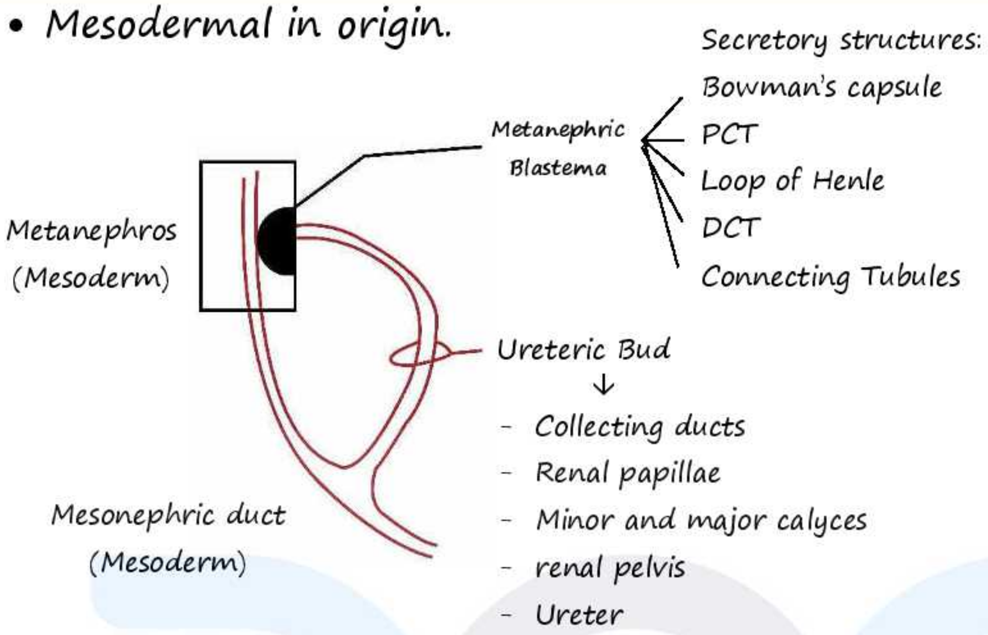
DOC TUTORIALS
LOGIN FOR SUCCESS

Development of Urinary Bladder 00:15:47

- Urinary bladder is derived from urogenital sinus (Endodermal in origin) except the trigone.
- Trigone is derived from absorbed part of mesonephric duct (mesodermal)

Development of Kidney 00:18:07

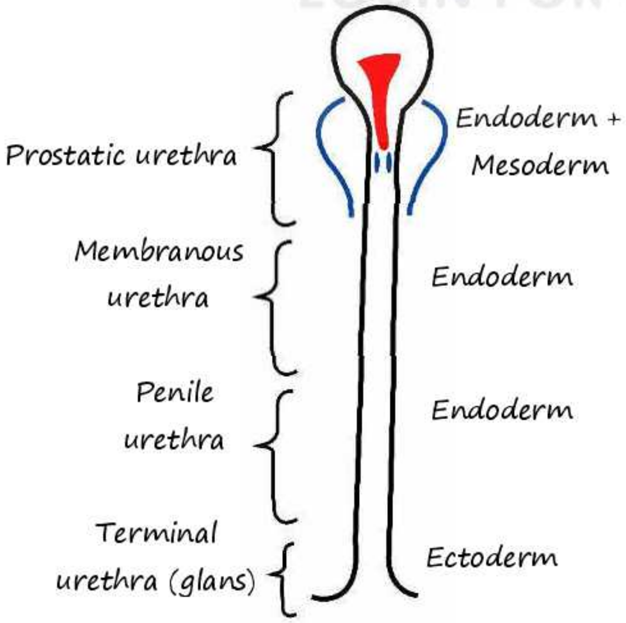
- Mesodermal in origin.


Secretory structures:
Bowman's capsule
PCT
Loop of Henle
DCT
Connecting Tubules
Metanephric Blastema
Metanephros (Mesoderm)
Ureteric Bud
↓
- Collecting ducts
- Renal papillae
- Minor and major calyces
- renal pelvis
- Ureter
Mesonephric duct (Mesoderm)

- Ureter is derived from the mesonephros part.

Male Urethra 00:26:25

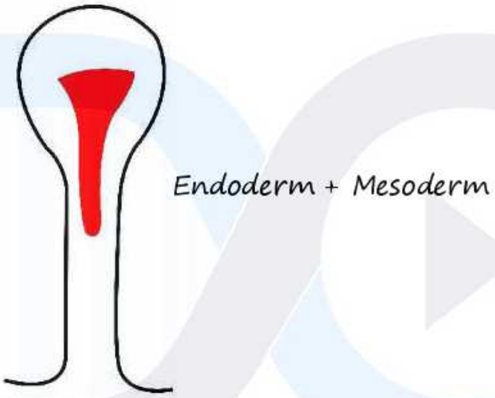
- Derived from urogenital sinus (endodermal)
- Except posterior wall of prostatic urethra (mesonephric duct) – Mesodermal.
- 20 cms in length


Prostatic urethra
Endoderm + Mesoderm
Membranous urethra
Endoderm
Penile urethra
Endoderm
Terminal urethra (glans)
Ectoderm

- Male urethra is derived from all the 3 germ layers: Ectoderm Endoderm and the mesoderm.

Female Urethra 00:33:39

- Female urethra – 4 cms in length
- Derived from urogenital sinus (Endodermal); except the posterior wall (mesonephric duct – mesodermal)



Wolffian duct/Mesonephric duct 00:33:39

Males	Females
1. Ureteric bud and its derivatives.	1. Ureteric bud and its derivatives
2. Trigone of urinary bladder	2. Trigone of urinary bladder
3. Posterior wall of prostatic urethra	3. Posterior wall of urethra.
4. Epididymis Ductus deferens Seminal vesicles	4. Gartner's duct.

TUTORIALS LOGIN FOR SUCCESS

Ejaculatory ducts Appendix of epididymis	

Mullerian duct/Paramesonephric duct 00:42:54

Males	Females
• Appendix of testes • Prostatic utricle	• Fallopian tubes • Uterus – Fundus – Body – Cervix • Upper part of vagina

- Genital ridge → Testes (males)/Ovaries (Females)
- Genital tubercle → Glans penis (males)/Clitoris (Females)
- Genital swelling → Scrotum (males)/Labia majora (Females)
- Genital fold (urethral fold) → Ventral aspect of penis (Males)/Labia minora (females)

PHARYNGEAL APPRATUS

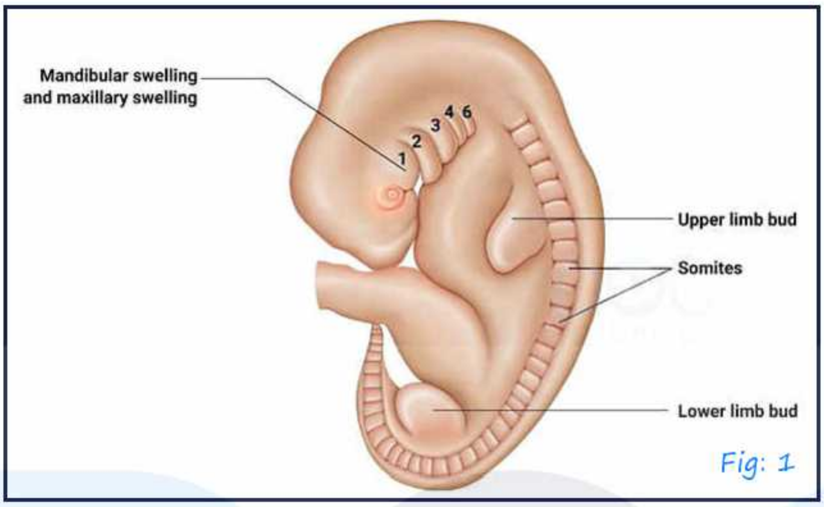

Mandibular swelling and maxillary swelling
1
2
3
4
6
Upper limb bud
Somites
Lower limb bud

Fig: 1

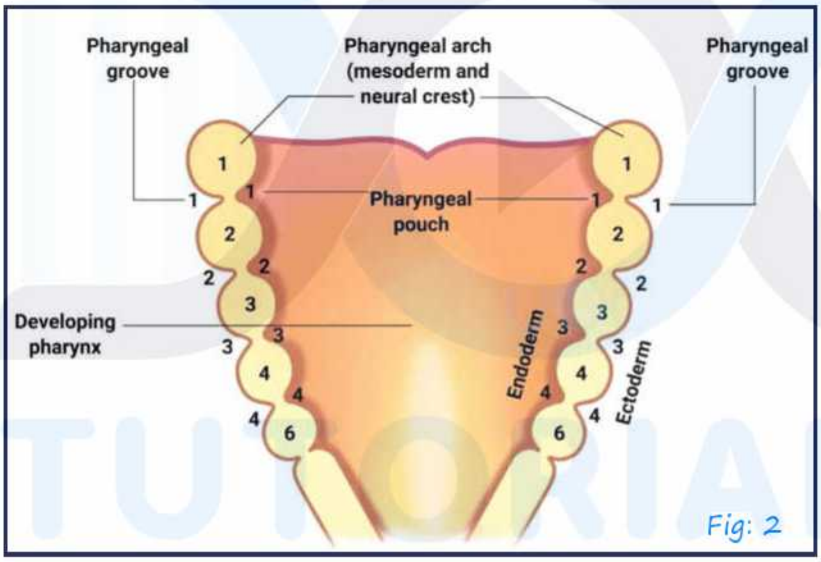

Pharyngeal groove
Pharyngeal arch (mesoderm and neural crest)
Pharyngeal groove
Pharyngeal pouch
Developing pharynx
Endoderm
Ectoderm
1
2
3
4
6

Fig: 2

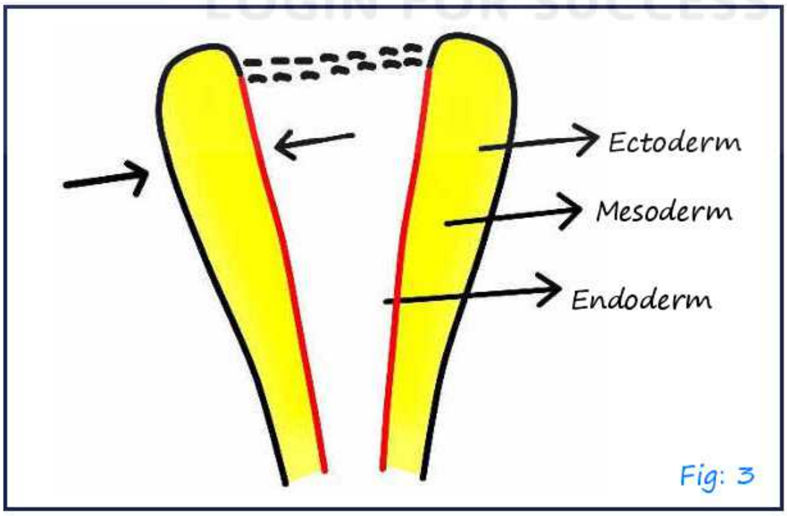

Ectoderm
Mesoderm
Endoderm

Fig: 3

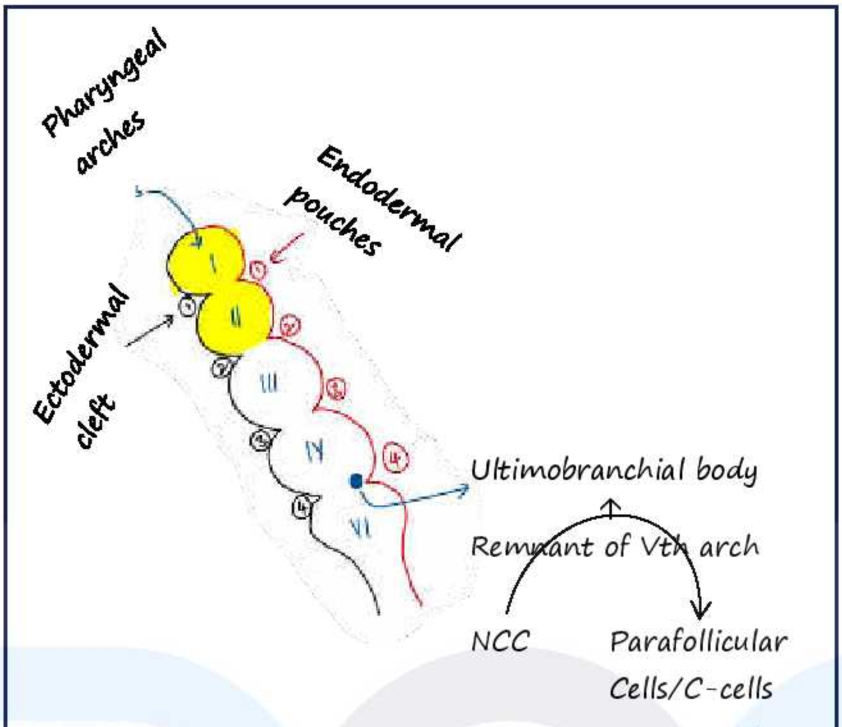

Pharyngeal arches
Endodermal pouches
Ectodermal cleft
I
II
III
IV
VI
1
2
3
4
Ultimobranchial body
Remnant of Vth arch
NCC
Parafollicular Cells/C-cells

Fig: 4

Ectodermal clefts – And endodermal pouches

00:12:03

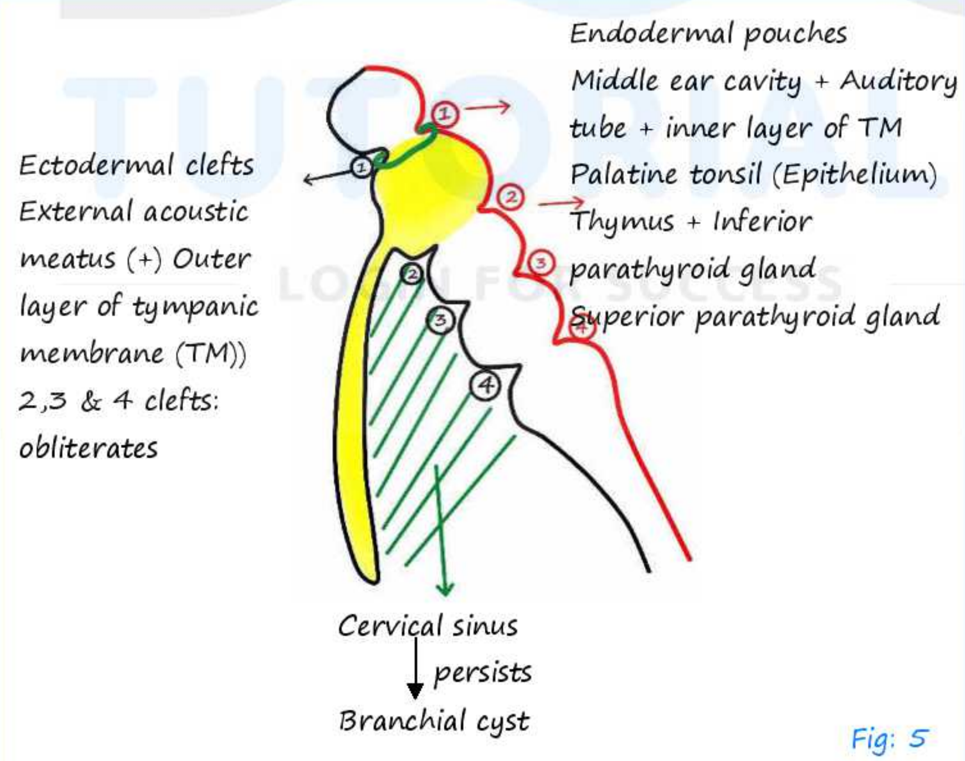

Endodermal pouches
Middle ear cavity + Auditory tube + inner layer of TM
Palatine tonsil (Epithelium)
Thymus + Inferior parathyroid gland
Superior parathyroid gland
Ectodermal clefts
External acoustic meatus (+) Outer layer of tympanic membrane (TM))
2,3 & 4 clefts: obliterates
1
2
3
4
Cervical sinus
persists
Branchial cyst

Fig: 5

- Tympanic membrane (TM) is derived from all the three germ layers.

Pharyngeal arches 00:24:21

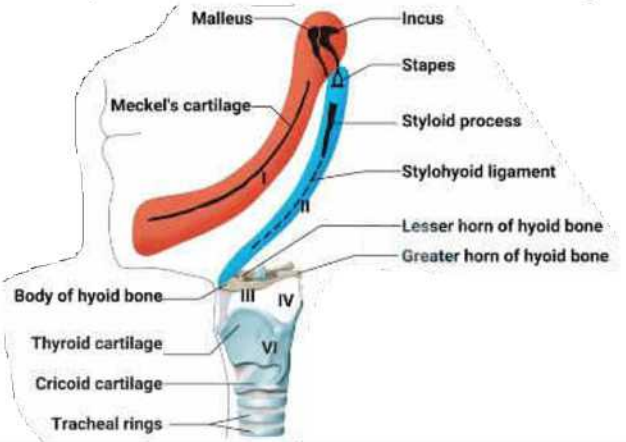
P. Arches	Nerve supply	
1	V3	Para sympathetic outflow/Craniosacral outflow
2	VII	Clotting factors (Vit-K) 2,7,9,10
3	IX	
4 6	Superior Laryngeal N Recurrent Laryngeal N	Pharyngeal arches 5 → 1 7 → 2 9 → 3 10 → 4 & 6

P. Arch	Nerve supply	Muscle derived
1	V3	- Muscles of mastication - Tensor veli palatini (TVP) - Tensor tympani - Anterior belly of digastric - mylohyoid

2	VII	- Muscle of facial expression including - Buccinator - Platysma - Auricular - Occipitals
		- Stapedius - Posterior belly of digastric - Stylohyoid
3	IX	- Stylopharyngeus
4	SLN	- Cricothyroid - Pharynx muscles except • Stylopharyngeus • cricopharyngeal - Palate except TVP
6	RLN	- Larynx except cricothyroid - Cricopharyngeal

Pharyngeal arch:

1. (Mandibular arch)	- Malleus, incus - Anterior ligament of malleus - Sphenomandibular ligament - Mandible

2.(Hyoid arch)	- Stapes expect the foot plate and annular ligament (Otic capsule) → Reichert's cartilage  Malleus Incus Stapes Meckel's cartilage Styloid process Stylohyoid ligament I II Lesser horn of hyoid bone Greater horn of hyoid bone Body of hyoid bone III IV Thyroid cartilage VI Cricoid cartilage Tracheal rings
3	- Greater horn and lower part of the body of hyoid bone
4	- All the cartilages of larynx, cricoid and base of arytenoid
6	- Cricoid and base of arytenoid

DEVELOPMENT OF TONGUE
AND THYROID GLAND

Development of Tongue 00:00:15

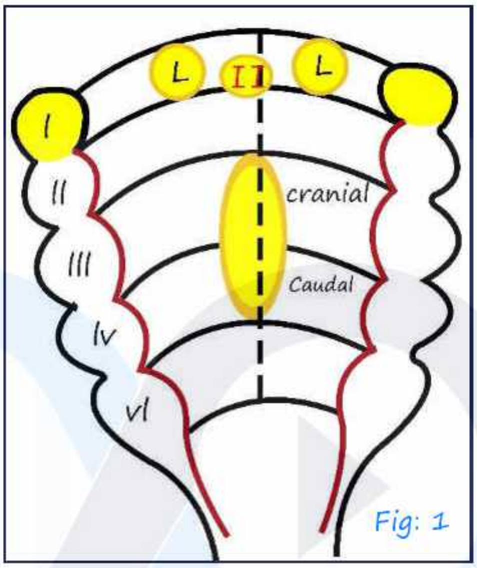


Fig: 1

DX TUTORIALS
LOGIN FOR SUCCESS

L-Lingual Swelling] Mesodermal Swellings
TI - Tuberculum Impar] 1st ARCH

- Hypobranchial Eminence] IIIrd IVth ARCh
→ Mesodermal Swelling

- The first arch → covered by Ectoderm on either side
  - Other arches → Ectoderm on the outside & Endoderm on the inside.

- Lingual swelling → Mesodermal thickenings
- Tuberculum impar ↗

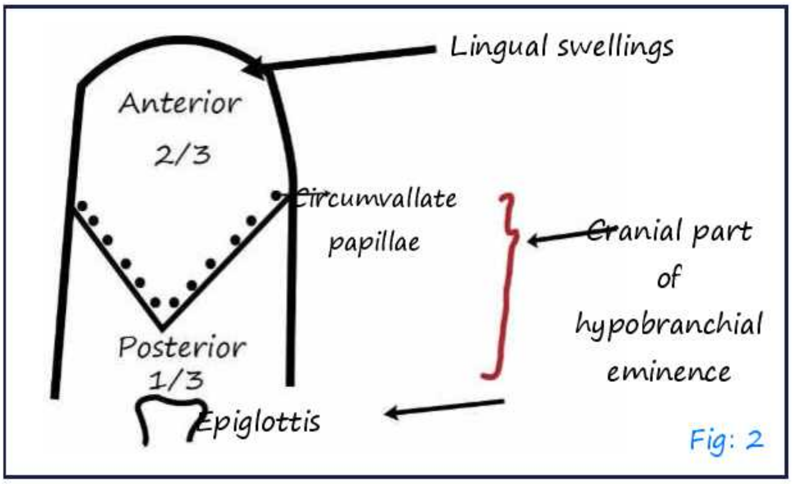

Lingual swellings
Anterior 2/3
Circumvallate papillae
Cranial part of hypobranchial eminence
Posterior 1/3
Epiglottis

Fig: 2

Muscles of Tongue 00:10:17

- Occipital somites
- Except Palatoglossus

Epithelium 00:11:57

- Anterior 2/3rd → Ectoderm
- Posterior 1/3rd → Endoderm

Development of Thyroid Gland 00:13:35

DOC TUTORIALS LOGIN FOR SUCCESS

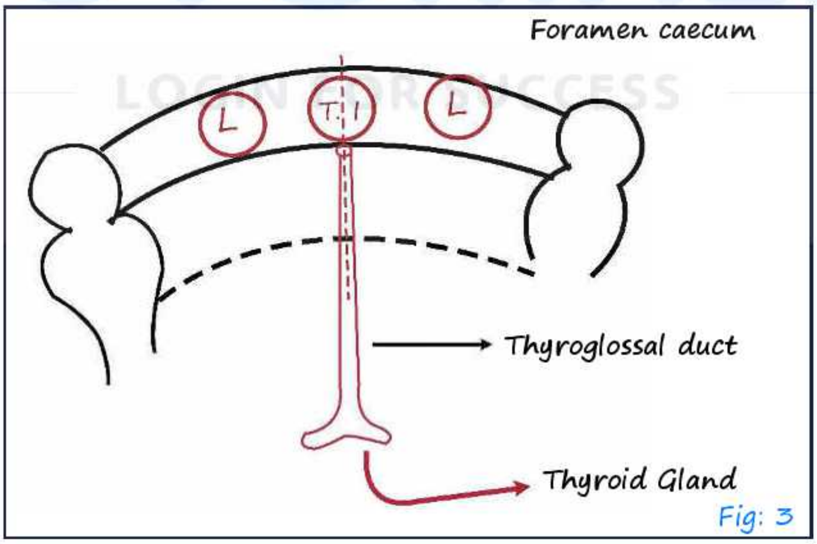

Foramen caecum
L
T.I
L
Thyroglossal duct
Thyroid Gland

Fig: 3

DEVELOPMENT OF FACE AND PALATE

- Development of Face:

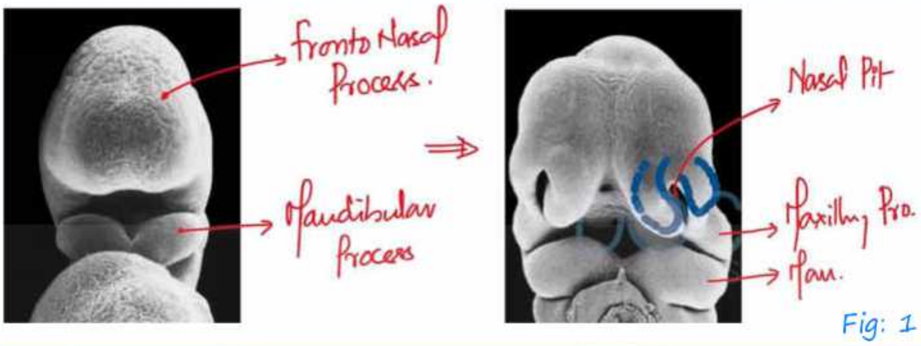
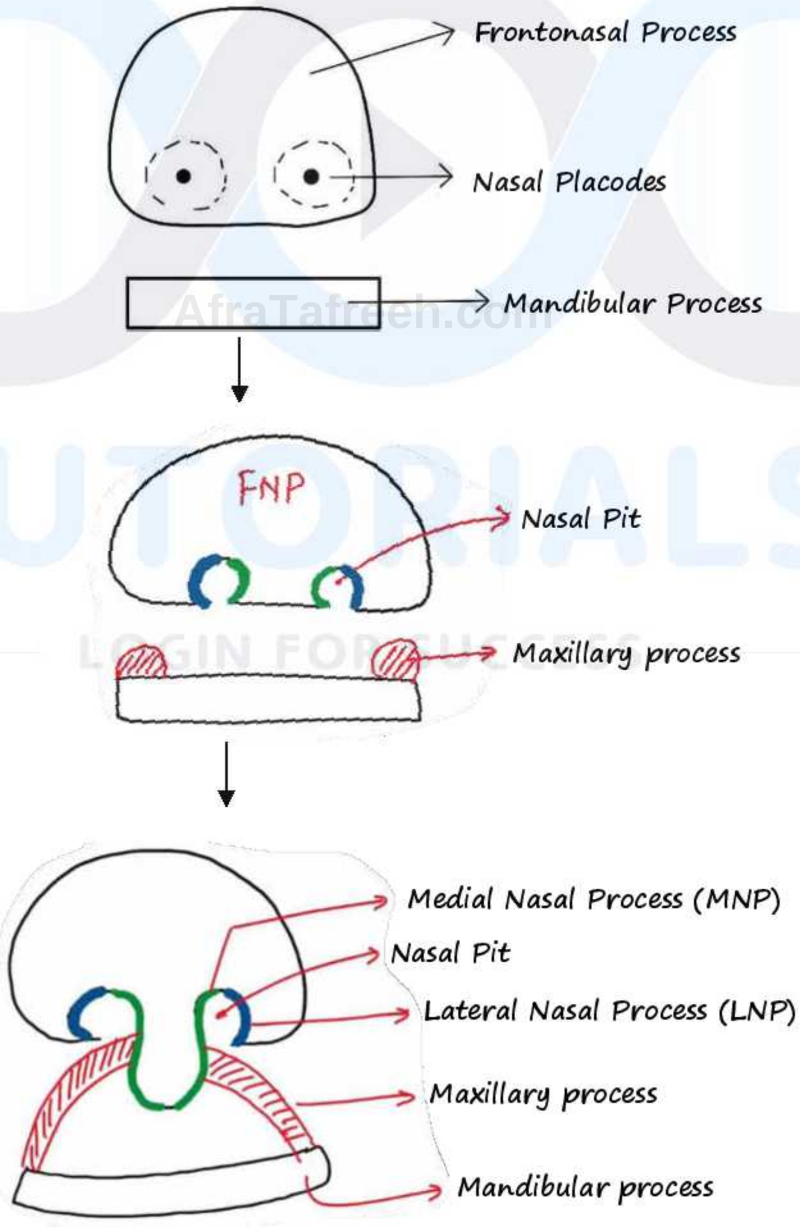

Fronto Nasal Process.
Mandibular Process
Nasal Pit
Maxillary Pro.
Man.

Fig: 1


Frontonasal Process
Nasal Placodes
Mandibular Process
FNP
Nasal Pit
Maxillary process
Medial Nasal Process (MNP)
Nasal Pit
Lateral Nasal Process (LNP)
Maxillary process
Mandibular process

DOT TUTORIALS
LOGIN FOR SUCCESS

Lower lip 00:08:55

- Formed by the fusion of Mandibular process
- Midline cleft of lower lip → Non-fusion of Mandibular process

Upper lip 00:10:27

- Formed by the fusion of Maxillary Process with the Medial Nasal Process.
  1. Unilateral cleft Upper lip → non-fusion of maxillary process and Medial Nasal process
  2. Bilateral Cleft Upper lip (hare lip) → Non-fusion of both Maxillary process and Medial Nasal Process of either side
  3. Midline Cleft Upper Lip → Non-fusion of both medial nasal process

Alae of nose 00:14:38

- Derived from lateral nasal process
- Oblique facial cleft → non-fusion of maxillary process and the lateral nasal process

Derivatives of medial nasal process 00:15:54

- Tip of the nose
- Columella
- Philtrum
- Incisive process of palate

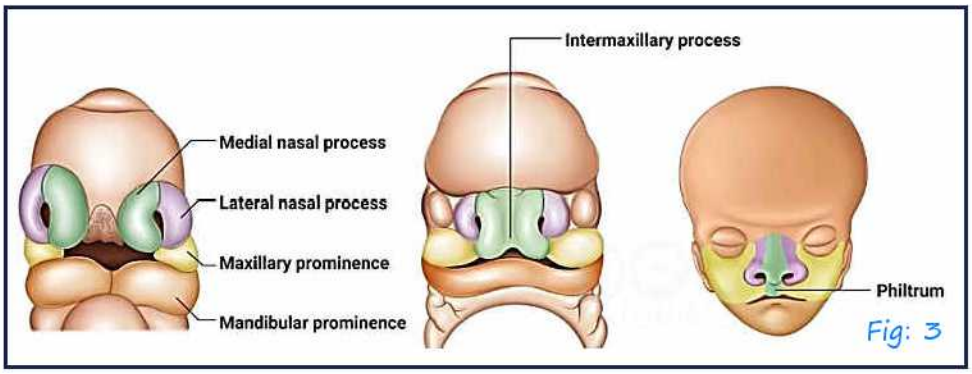

Medial nasal process
Lateral nasal process
Maxillary prominence
Mandibular prominence
Intermaxillary process
Philtrum

Fig: 3

Development of palate 00:17:44

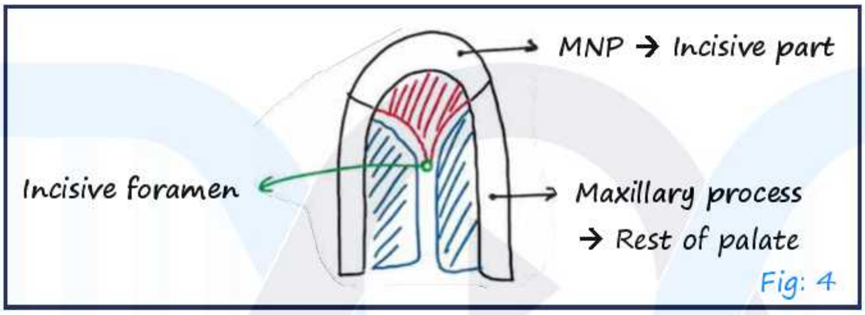

MNP → Incisive part
Incisive foramen
Maxillary process
→ Rest of palate

Fig: 4

Muscles of the palate 00:20:28

- Derived from 4th arch except Tensor Veli Palatine (TVP) muscle, which is derived from the 1st arch

CNS EMBRYOLOGY

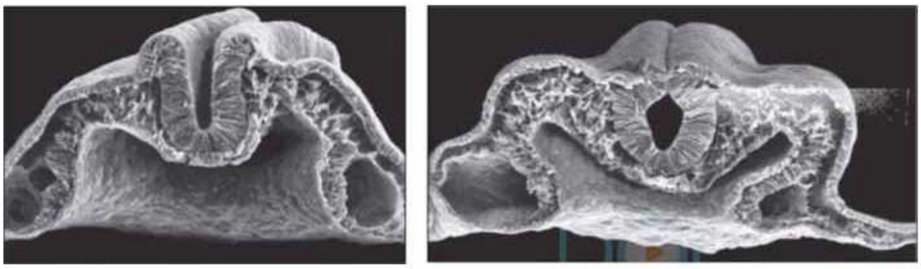
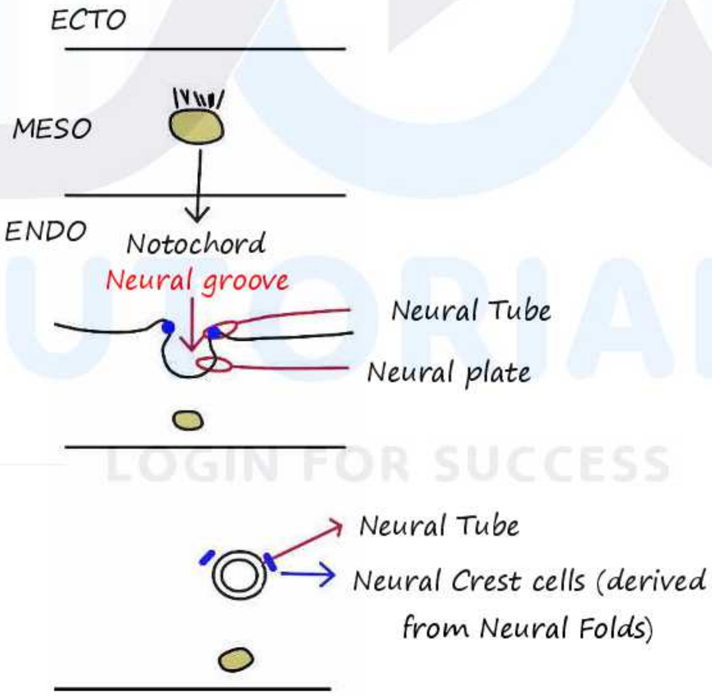


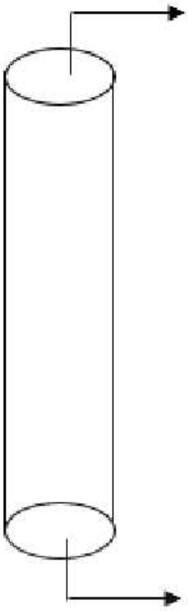
Fig: 1

Neurulation 00:00:40

- Formation of Neural tube
- Begins in 3rd week of Development


ECTO
MESO
ENDO
Notochord
Neural groove
Neural Tube
Neural plate
Neural Tube
Neural Crest cells (derived from Neural Folds)

NEURAL TUBE
↓
CNS
- Brain
- Spinal Cord



→ Cranial/ Anterior/ Rostral Neuropore
[Closed on 25th day (d_{25})]
↓
Anencephaly

→ Caudal / Posterior Neuropore
[closes on D_{27} / D_{28}]
↓
Spina Bifida

DOC TUTORIALS LOGIN FOR SUCCESS

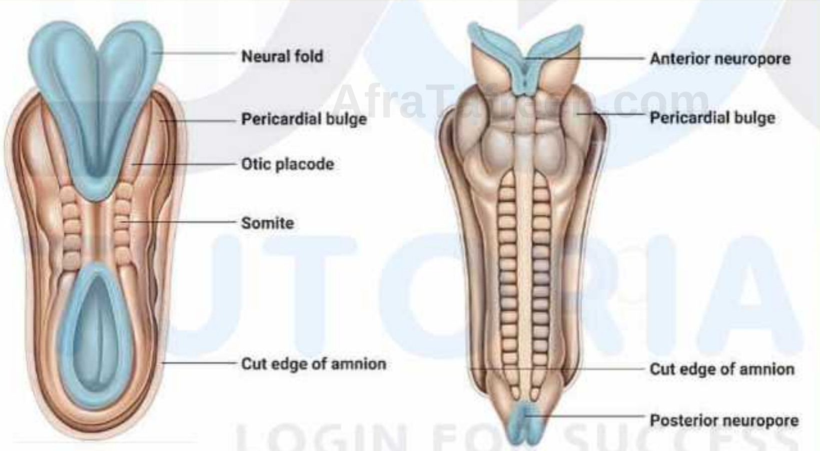

Neural fold
Pericardial bulge
Otic placode
Somite
Cut edge of amnion
Anterior neuropore
Pericardial bulge
Cut edge of amnion
Posterior neuropore

Fig: 2

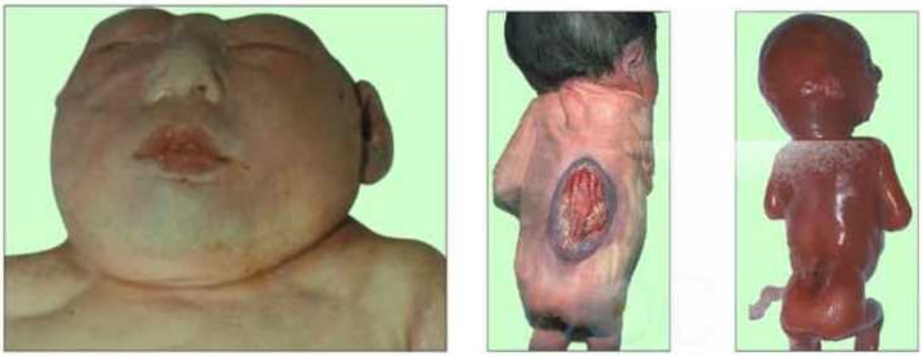
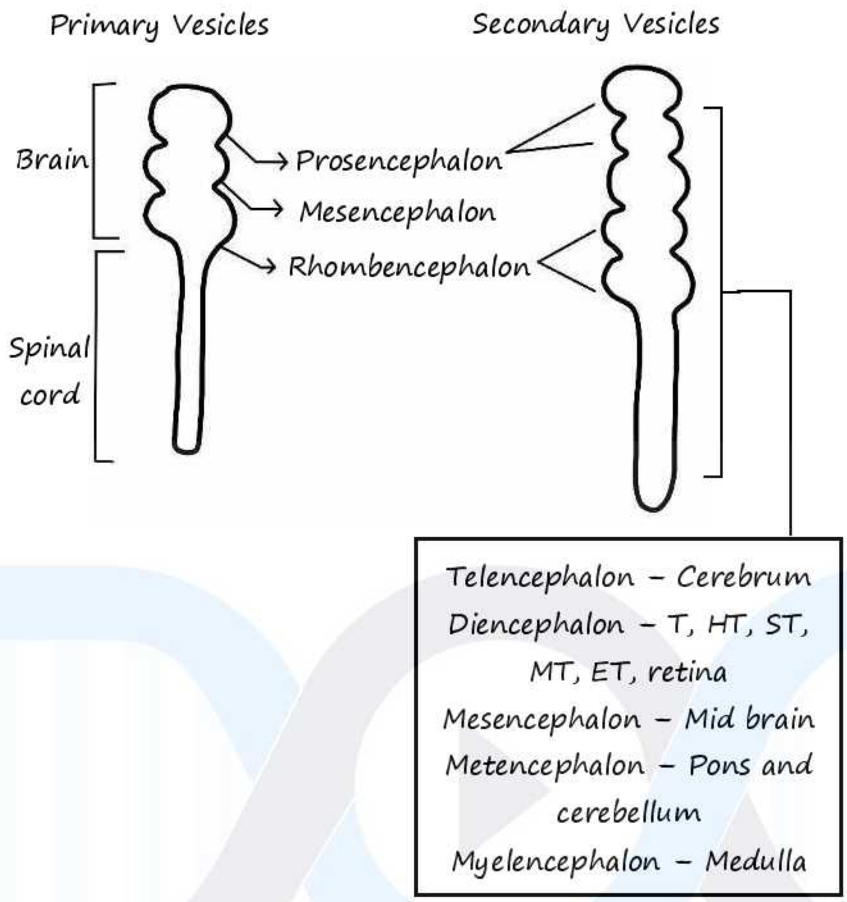


Fig: 3

Neural Tube

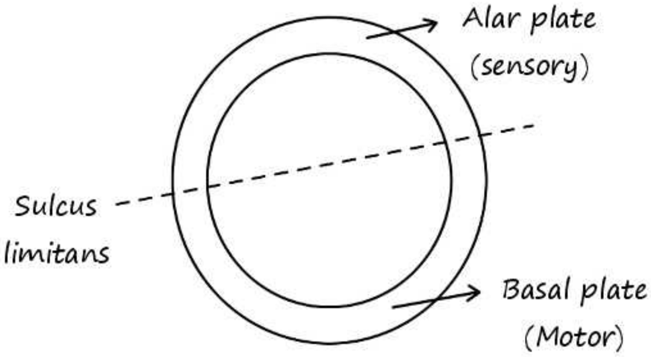

Primary Vesicles
Secondary Vesicles
Brain
Spinal cord
Prosencephalon
Mesencephalon
Rhombencephalon
Telencephalon – Cerebrum
Diencephalon – T, HT, ST, MT, ET, retina
Mesencephalon – Mid brain
Metencephalon – Pons and cerebellum
Myelencephalon – Medulla

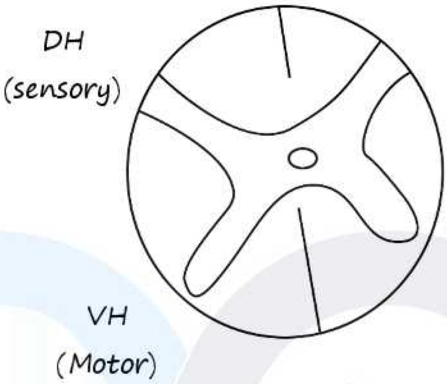
DOC TUTORIALS
LOGIN FOR SUCCESS

- Hind Brain is formed by the RHOMBENCEPHALON:
  i. Metencephalon → Pons and Cerebellum
  ii. Myelencephalon → Medulla Oblongata
- Forebrain is Derived from Telencephalon and Diencephalon.

Spinal Cord 00:17:00

Neural Tube (TS)


Alar plate
(sensory)
Sulcus
limitans
Basal plate
(Motor)


DH
(sensory)
VH
(Motor)

- Neural crest cells are derived from Neural folds

DEVELOPMENT OF DIAPHRAGM

Diaphragm develops from four sources 00:00:15

- Septum transversum → it forms central tendon of diaphragm
- Cervical myotomes → it forms muscular part of diaphragm (body wall mesoderm)
- Dorsal meso-oesophagus → it forms the crus of the diaphragm
- Pleuroperitoneal membrane → contributes for the formation of diaphragm.

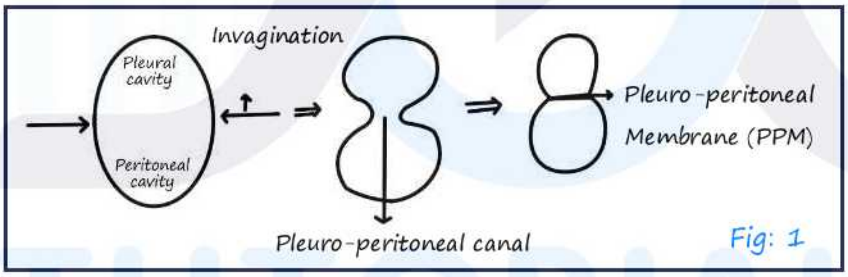

Invagination
Pleural cavity
Peritoneal cavity
Pleuro-peritoneal Membrane (PPM)
Pleuro-peritoneal canal

Fig: 1

- Pleuro-peritoneal canal usually closes, but sometimes it persists, and can lead to absence of PPM causing congenital diaphragmatic hernia
- Sometimes, the formed PPM is very thin leading to evertration of diaphragm.

Top view of diaphragm

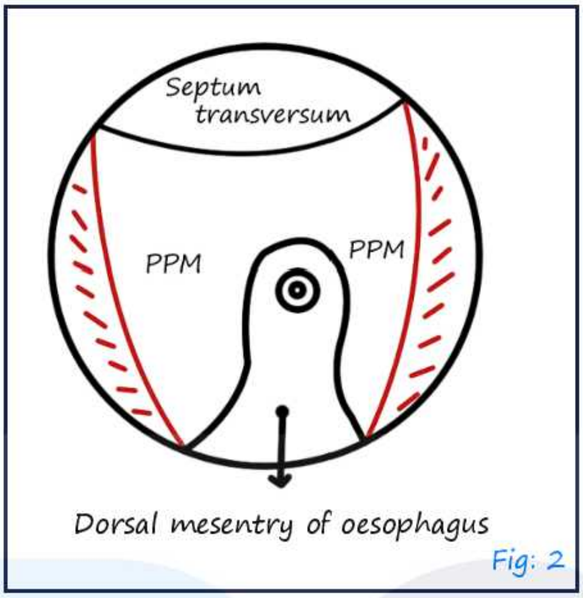

Septum transversum
PPM
PPM
Dorsal mesentry of oesophagus

Fig: 2

TYPES OF JOINTS

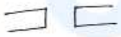
There are three types of joint

Fibrous joint (Immobile)	Cartilaginous joint (partially mobile)	Synovial joint (mobile joint)
Sutures	Primary	
Gomphosis	Secondary	
Syndesmosis		

Fibrous joint

1) Sutures:

a)Plane sutures – end of the bones are plane and they are joined in the middle by fibrous tissue.



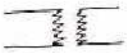
Example:

i. internasal suture

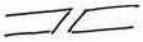
ii. Interpalatine suture

b)Serrate sutures – end of the bones are serrated.

Example: saggital suture



c)Squamous suture – End of one bone is overlapping with another bone.



Example: temporoparietal suture

d) Dentate suture- end of one bone has dentations and the other bone fit into those dentation

Example: Lambdoid suture

e) Schindylesis (Ridge and groove) – suture

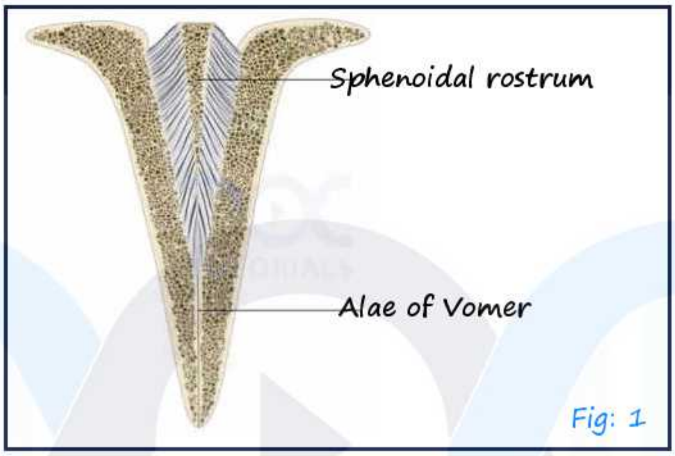


Fig: 1

Here, rostrum of the sphenoid bone fits into the alae of vomer

2) Gomphosis (Dento-alveolar joint)

- It is the joint between the tooth and socket.

3) Syndesmosis

Example:

i. The inferior tibiofibular joint is joined with a help of a membrane.

Fig: 2

ii. The middle radio-ulnar joint are joined by the help of an interosseus membrane.

Fig: 3

iii. Sacro-iliac joint

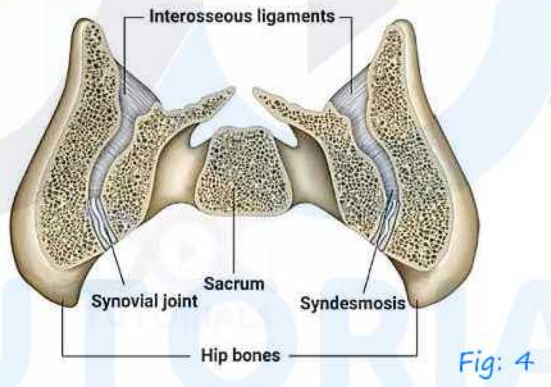

Interosseous ligaments
Sacrum
Synovial joint
Syndesmosis
Hip bones

Fig: 4

Cartilagenous Joint 00:14:25

1. Primary cartilaginous joint/synchondrosis:

- They are joined in the middle with the help of a cartilage known as hyaline cartilage.

- Hyaline cartilage has the property of ossification i.e., it ossifies after certain age which later becomes a bone. Hence, it is a temporary joint.
- Synchondrosis becomes synostosis

- Example:

  i. The joint between epiphysis and diaphysis

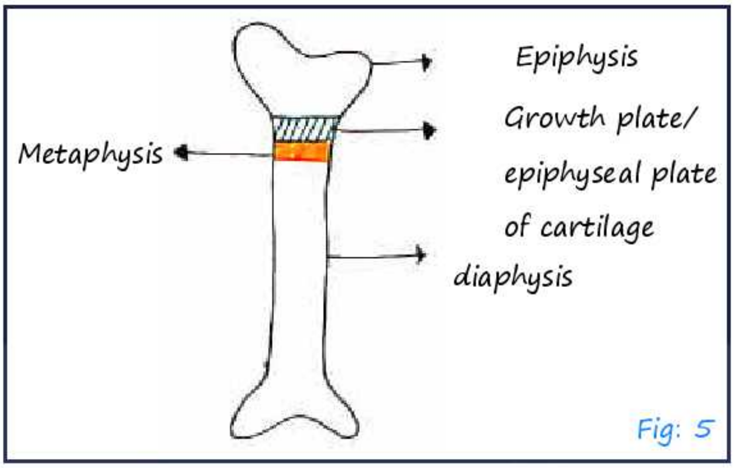

Epiphysis
Growth plate/ epiphyseal plate of cartilage
Metaphysis
diaphysis

Fig: 5

ii. All costochondral joints

2.Secondary cartilaginous joint/symphysis:

- The end of the bones are covered by hyaline cartilage & they in turn are attached by fibrous cartilage.

TUTORIALS LOGIN FOR SUCCESS

- It is a permanent joint.
- Example: all midline joints are example

  1.Manubriosternal joint

  2.Xiphisternal joint

  3.Intervertebral disc

  4.Pubic symphysis
- Except symphysis menti

Synovial Joint 00:24:23

- Upper limb

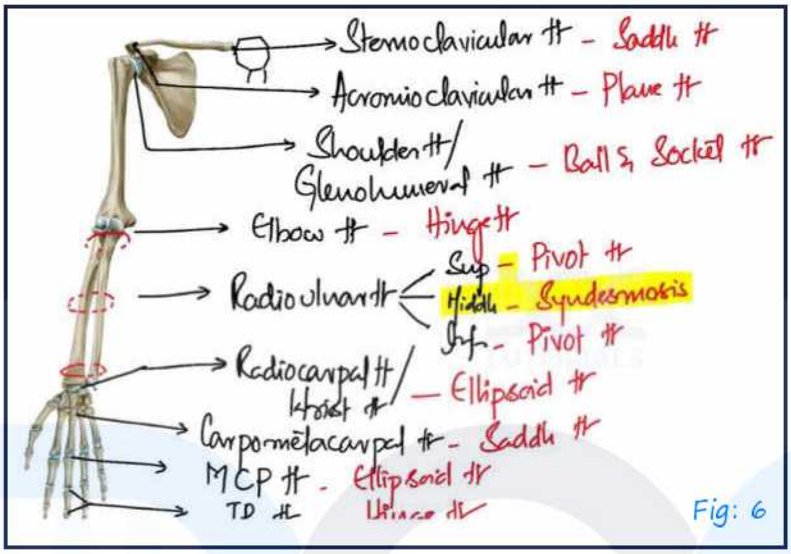

Sternoclavicular Jt - Saddle Jt
Acromioclavicular Jt - Plane Jt
Shoulder Jt/ Glenohumeral Jt - Ball & Socket Jt
Elbow Jt - Hinge Jt
Radioulnar Jt
Sup - Pivot Jt
Middle - Syndesmosis
Inf - Pivot Jt
Radiocarpal Jt/ Wrist Jt - Ellipsoid Jt
Carpometacarpal Jt - Saddle Jt
MCP Jt - Ellipsoid Jt
ID Jt
Hinge Jt

Fig: 6

1.Sterno clavicular joint → Saddle joint

2.Acromio-clavicular joint → plane joint

3.Shoulder joint → Ball & socket joint

4.Elbow joint → Hinge joint

5.Radio – ulnar joint

- Superior →pivot joint
- Middle → syndesmosis
- Inferior → pivot joint

6.Radio – carpal joint → Ellipsoid joint

7.Carpo – metacarpal joint → Saddle joint

8.Meta – carpophalyngeal joint → Ellipsoid joint

9.Inter – phalyngeal joint → Hinge joint

- Lower limb

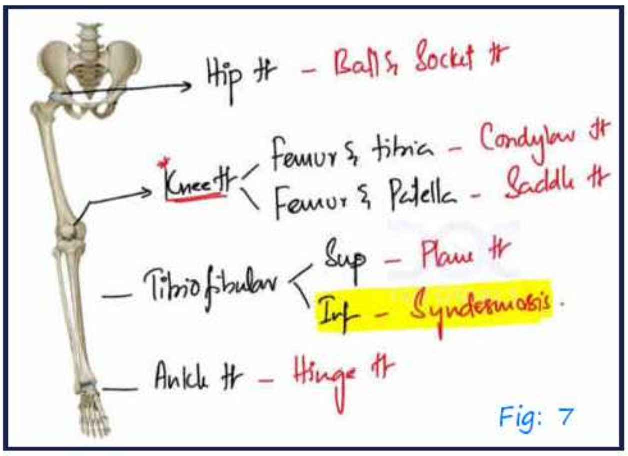

Hip # - Ball & Socket #
Knee #
Femur & tibia - Condylar #
Femur & Patella - Saddle #
Tibiofibular
Sup - Plane #
Inf - Syndesmosis.
Ankle # - Hinge #

Fig: 7

- Foot

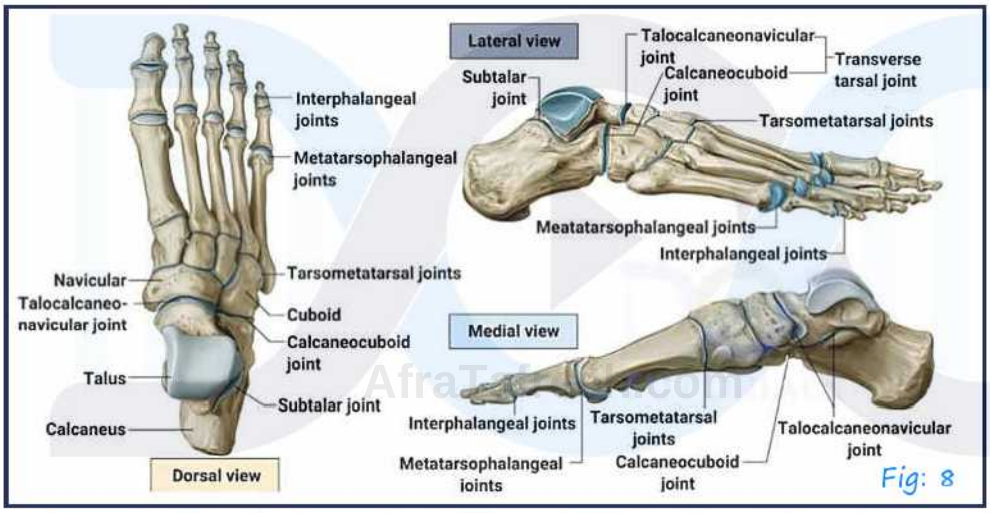

Lateral view
Subtalar joint
Talocalcaneonavicular joint
Calcaneocuboid joint
Transverse tarsal joint
Tarsometatarsal joints
Meatatarsophalangeal joints
Interphalangeal joints
Interphalangeal joints
Metatarsophalangeal joints
Tarsometatarsal joints
Navicular
Talocalcaneo-navicular joint
Cuboid
Calcaneocuboid joint
Talus
Subtalar joint
Calcaneus
Dorsal view
Medial view
Interphalangeal joints
Tarsometatarsal joints
Metatarsophalangeal joints
Calcaneocuboid joint
Talocalcaneonavicular joint

Fig: 8

DOC TUTORIALS
LOGIN FOR SUCCESS

- Calcaneus & Navicular forms a socket & the talus fits there.

  Talocalcaneonavicular joint is an example of ball & socket joint.

Thoracic Wall

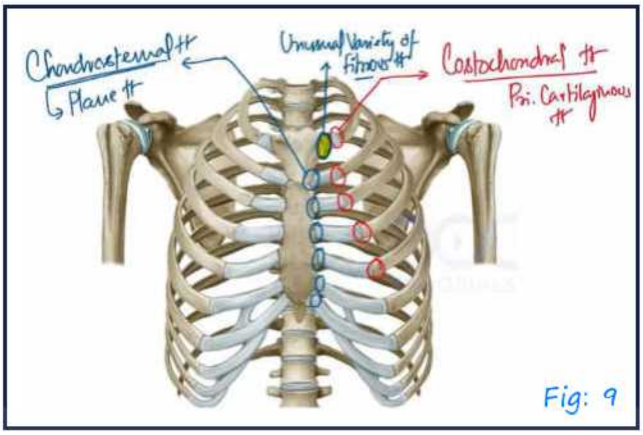
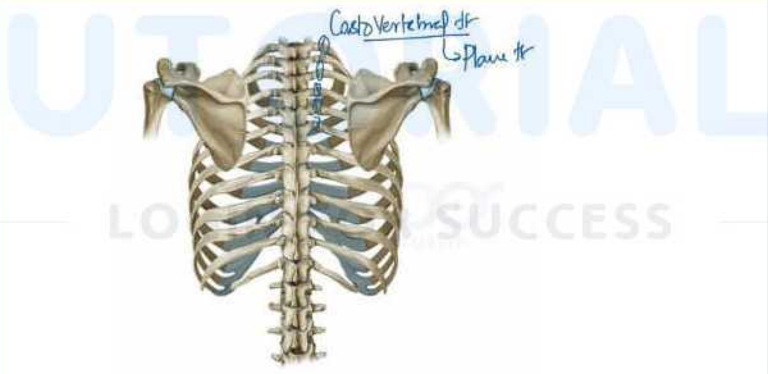

Chondrosternal #
↳ Plane #
Unusual Variety of fibrous #
Costochondral #
Pri. Cartilaginous #

Fig: 9

- Costochondro joint → primary cartilaginous joint
- Chondrosternal joint → plane synovial joint
- 1st Chondrosternal joint is an unusual variety of fibrous joint and not a plane synovial joint.

Back


Costo Vertebral #
↳ Plane #

Costovertebral joint – plane joint Fig: 10

- Joint between Atlas & Axis is Atlanto axial joint

Pivot joint

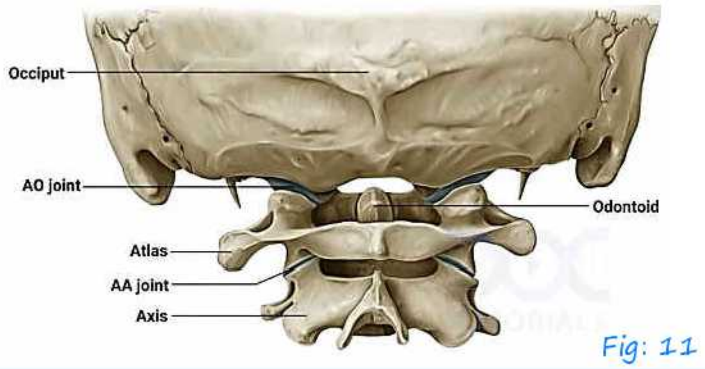

Occiput
AO joint
Odontoid
Atlas
AA joint
Axis

Fig: 11

- Atlanto - occipital joint → ellipsoid joint

EPITHELIUM

- Epithelium is the covering on the outer surface of the body as well as the inner body cavities.

Classification

Simple & stratified based on the number of layers.
↓ ↓
Unilayer Multiple layers

Simple epithelium 00:01:11

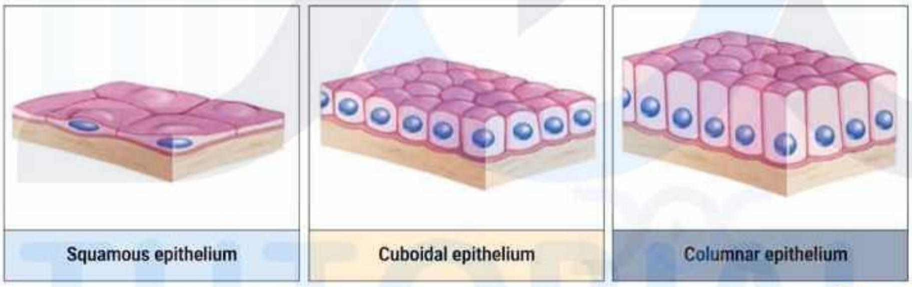

Squamous epithelium
Cuboidal epithelium
Columnar epithelium

Fig: 1

1. Squamous epithelium
   a. It has flattened cells and flattened nucleus.
   b. It is present mostly where you have exchange such as alveoli, Bowman's capsule.
2. Cuboidal epithelium
   a. Height & width of the cell is almost same.
   b. It has round spherical nucleus in the center.
3. Columnar epithelium
   a. They are longer / tall cells

TUTORIALS LOGIN FOR SUCCESS

b. Nucleus is elongated & is present more towards the basal membrane

Stratified epithelium 00:04:21

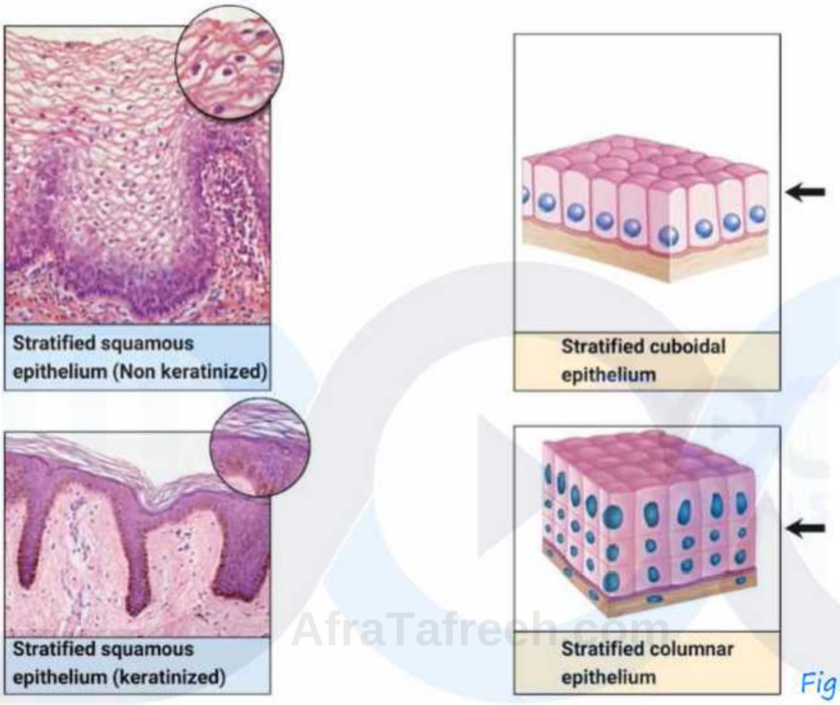

Stratified squamous epithelium (Non keratinized)
Stratified cuboidal epithelium
Stratified squamous epithelium (keratinized)
Stratified columnar epithelium

Fig: 2

- It is named based on the top most layer of the cells

Pseudostratified columnar cells 00:06:28

- All the cells rest on the base of the membrane in a single layer but appears as multiple layer because of the positioning of the nuclei.

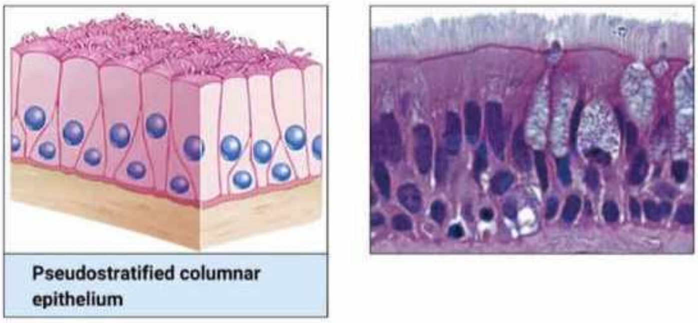

Pseudostratified columnar epithelium

Fig: 3

Transitional epithelium / urothelium 00:07:56

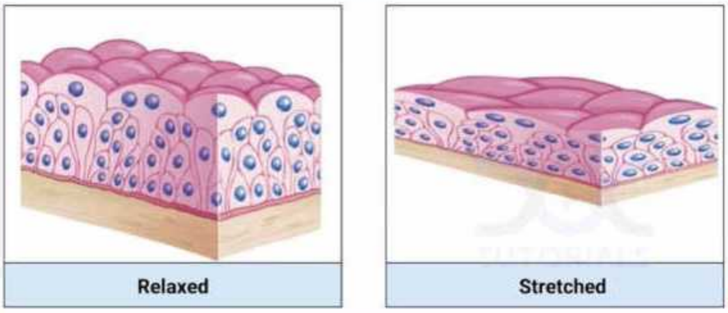


Fig: 4

- Transitional epithelium is also seen in urinary tract hence it is also known as urothelium.
- Above, they have umbrella shaped cells. It encloses many cells beneath them.
- It is present in relaxed & stretched state.

Gastrointestinal Tract 00:11:58

1. Oral cavity → stratified squamous epithelium (non-Keratinized)
   - Exception:
     i. Hard palate – para- Keratinized
     ii. Vermilion border of lip – Keratinized epithelium.
     iii. Filiform papillae of tongue – Keratinized.
2. Oesophagus → Stratified squamous epithelium (non-Keratinized)
3. Stomach
   i. Simple columnar epithelium
   ii. It is covered by mucous layer in order ot protect from HCl

4.Small Intestine

i. Tall columnar cells with striated border.
(for absorption, surface area has to be increase, hence the villi has micro villi that gives striated appearance.)

5.Large Intestine

i. Tall columnar cells with striated border.
(Large number of goblet cells are present that secretes mucous)

6.Anal Canal → Has 3 zone

i. Colorectal zone – simple columnar epithelium.
ii. Anal transitional zone – stratified columnar epithelium.
iii. Squamous zone – stratified squamous epithelium

Respiratory tract 00:18:16

Nasal mucosa
Paranasal Air sinus
Larynx
Trachea
Bronchus
Proximal bronchiole

Pseudostratified ciliated columnar epithelium (Cilia gives direction of the movement of mucosa)

- Terminal bronchiole – Ciliated cuboidal epithelium
- Respiratory bronchiole – non-ciliated cuboidal epithelium.

AfraFarooq.com TUTORIALS LOGIN FOR SUCCESS

- Alveoli – Simple squamous epithelium

Urinary tract 00:20:36

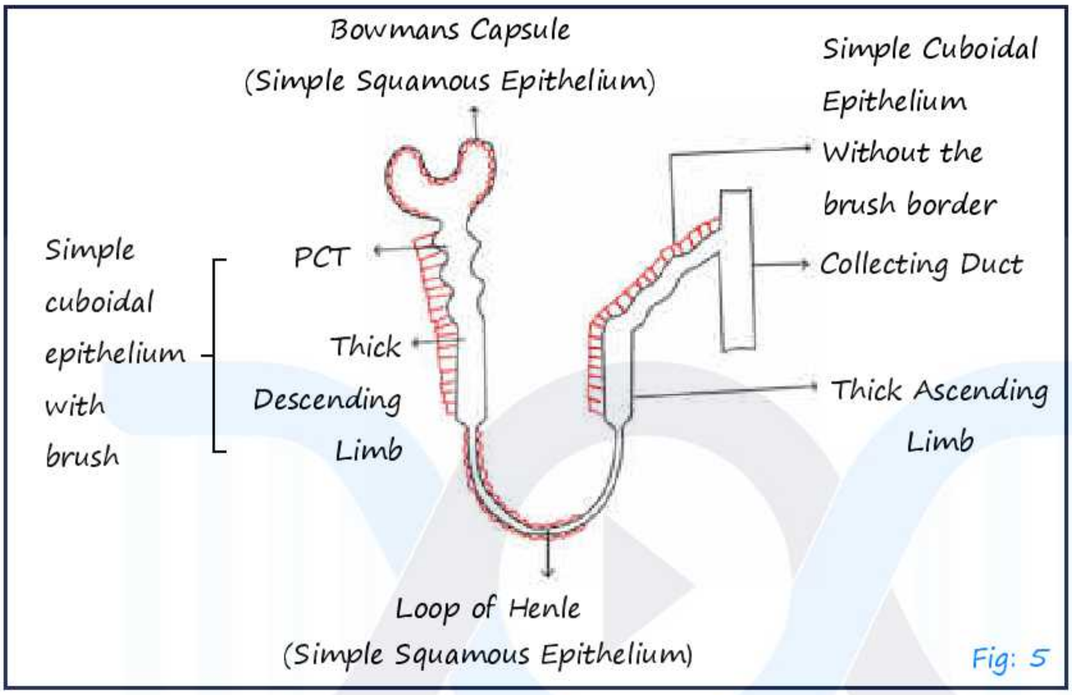

Bowmans Capsule
(Simple Squamous Epithelium)
Simple Cuboidal
Epithelium
Without the
brush border
Simple
cuboidal
epithelium
with
brush
PCT
Thick
Descending
Limb
Collecting Duct
Thick Ascending
Limb
Loop of Henle
(Simple Squamous Epithelium)

Fig: 5

- After the collecting duct, it opens into the calyces.

Minor and major Calyces
↓ opens into
Renal Pelvis
↓
Ureter
↓
Urinary bladder
↓
Prostatic urethra

Transitional epithelium or Urothelium

↓
Membranous urethra
↓
Spongy urethra

Pseudostratified columnar epithelium

↓
Terminal urethra → stratified squamous epithelium